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THE EFFICACY OF ANTI-MENINGOCOCCAL SERUM IN
THE PRESENT EPIDEMIC OF CEREBRO-SPINAL
MENINGITIS.*

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SINCE the beginning of the year cerebro-spinal meningitis has shown a considerable recrudescence in various parts of our territory, both in the civil population and in the army. This recrudescence is not peculiar to France. The English medical journals and society reports show that our allies are also interested in this question. Among them, as with us, doubts have been expressed as to the efficacy of intra-spinal injections of anti-meningococcal serum.

The Académie de Médecine, where I have championed this truly specific treatment (8) (15) on several occasions since 1909, will understand my legitimate desire to protest against allegations of this kind.

I will do so by making use of my personal cases, which will be seen to be fairly numerous, since at the present date I have treated 226 cases of cerebro-spinal meningitis with serum, 45 of which occurred in the first half of 1915.

I propose to prove, first of all, that cerebro-spinal meningitis has been particularly frequent this year, and that its severity has been greater than in previous years.

* A communication made to the Académie de Médecine on June the 29th, 1915.

We will then indicate the results obtained by serum treatment, which were as satisfactory in 1915 as in previous years, and are shown not only by the lowering of the mortality, but also by the attenuation of the disease, and the diminished frequency of complications and sequelæ.

We will set forth the technique employed and will show what factors contributed to the good results and what causes were responsible for the various failures reported.

This account will, I hope, justify the confidence which, in our opinion, this valuable serum treatment deserves.

I. FREQUENCY OF CEREBRO-SPINAL MENINGITIS IN PARIS IN 1915. GRAVITY. COMPLICATIONS. TABLE OF CASES TREATED.

On June the 30th the number of cases treated by us was 47, distributed as follows :

January	.	.	.	3 cases, 1 in private practice
February	.	.	.	8 " 2 " "
March	.	.	.	8 " 2 " "
April	.	.	.	14 " 2 " "
May	.	.	.	9 " — "
June	.	.	.	5* " 1 " "

Prior to January the 1st, 1915, we had treated 180 patients by serum as follows :

1908	.	.	.	3 cases	1912	.	.	.	10 cases
1909	.	.	.	81 "	1913	.	.	.	21 "
1910	.	.	.	29 "	1914	.	.	.	21 "
1911	.	.	.	16 "					

Thus the first half of 1915 contains more cases than any of the previous years except 1909, a year in which the figures are not comparable. During the first months of the epidemic of 1909 our wards in the Hôpital Trousseau had been reserved for children with cerebro-spinal meningitis, and our colleague at this hospital did not have a single case. This year, however, 17 cases were admitted to his wards.

By adding these 17 cases to those we treated in 1915, and subtracting the cases treated in private practice, there results a total of 56 patients for the Hôpital Trousseau during the first 6 months of 1915, as compared with 52 cases treated by us at the same hospital during the first half of 1909.

* The last 2 cases admitted to hospital on June the 28th and the 30th do not figure in the table on pp. 356-8, which is reserved for completed cases.

The severity of the cases in the year 1915 was certainly not less than those in previous years. On the contrary we were struck by the unusual frequency of manifestations indicating a generalised infection, or to speak more precisely a *meningococcal septicæmia*.

We have never found such a large proportion of generalised eruptions, such as the *diffuse morbilliform eruptions* present in 5 of our patients, and especially *generalised purpura*, the exceptional gravity of which had been shown in the epidemics of "spotted fever" in America and Ireland.

Extra-meningeal localisations have also been more frequent than usual, such as *suppurative arthritis*, of which we noted 3 cases, *metastatic irido-cyclitis*, of which we had one example, and *ulcerative vegetative endocarditis* of which we had a case which will be published later.

Reports made here or in other societies, and other information brought to our knowledge have proved to us that this was not a mere coincidence, peculiar to our wards, but that it was characteristic of the epidemic throughout the extent of our territory.

To speak only of metastatic irido-cyclitis, so rare in the French epidemic of 1909, and of which we had seen only two examples among one hundred and eighty cases, we observed patients with this grave complication in the departments of Aveyron and Landes. We also saw several of these complications in the wards of our colleagues, Renault, Capitan, and Triboulet. In several of our patients in 1915 the invasion of the meninges was preceded for a varying period by signs indicating a general infection or by extrameningeal localisations. We noted cases in which *meningococcal septicæmia* existed *without there ever having been any meningitis*, as in a case recorded by us in 1909 (9).

These cases require serum treatment. They may be detected by blood cultures, the systematic use of which is very valuable.

II. RESULTS OF SERUM TREATMENT SINCE 1908, AND ESPECIALLY DURING THE FIRST SIX MONTHS OF 1915.

Since March, 1908, we have treated 226 cases of cerebro-spinal meningitis with serum, 170 of which were hospital patients, and 56 in private practice.

No single observer, as far as we know, has had so many cases under his personal supervision.

The number of deaths was 62, or a gross mortality of 27.4 per cent., which, after eliminating 16 deaths in less than 24 hours, falls

CEREBRO-SPINAL MENINGITIS IN 1915.

Hospital Cases.

Cases.	Date.	Sex.	Age.	Day of disease of injection.	Total amount of serum injected.	Origin of serum.	Principal feature of disease.	Result.
1	Jan. 15	M.	17 mos.	(?) 4 injections	82 c.c.	American and Dopter's mixed serum	Severe form with purpura, multiple arthritis, and broncho-pneumonia	Death.
2	" 25	F.	9 mos.	2nd, 3rd, 4th, 5th, 7th, 8th 4th	110 c.c.	Dopter's mixed	Breast-fed child	Recovery.
3	Feb. 6	M.	4 yrs.		30 c.c.	"	Fulminating case, moribund on admission	Death.
4	" 6	M.	4 yrs.	7th	30 c.c.	"	Improvement on admission. Twin brother of No. 3.	Recovery.
5	" 10	F.	2 yrs.	4th, 5th, 6th, 7th	110 c.c.	"	Severe case; transient meningeal symptoms	Rapid recovery.
6	" 12	M.	5½ yrs.	7th, 8th, 9th	80 c.c.	"	Severe case	Rapid recovery.
7	" 18	M.	3½ yrs.	5th, 6th, 7th, 8th	115 c.c.	"	Severe case	Rapid recovery.
8	" 22	M.	2½ yrs.	5th, 6th, 7th, 8th	110 c.c.	"	Severe case. Suppurative irido-choroiditis. Local treatment by serum	Recovery. Eye improved.
9	Mar. 3	F.	8 yrs.	6th, 7th, 8th	90 c.c.	"	Very marked rigidity	Rapid recovery.
10	" 21	F.	7½ yrs.	10th, 11th, 12th, 13th	110 c.c.	Dopter's mixed and American	Severe case, with right hemiplegia and deafness	Rapid recovery. Permanent deafness; cure of hemiplegia.
11	" 22	F.	4 yrs.	3rd, 4th, 5th	90 c.c.	Do.	Moderate form. Facial paralysis on admission	Rapid recovery. Per-
12	" 23	M.	5 yrs.	3rd, 4th, 5th, 6th	120 c.c.	"	Moderate form	manent deafness; Recovery. Disappearance of paralysis.
13	" 29	F.	5 yrs.	6th, 7th, 8th, 9th, 10th	130 c.c.	American	Severe form. Lived with cousin who died of fulminating meningitis	Rapid recovery.

14	"	29	M.	5 yrs.	4th, 5th, 6th	90 c.c.	American	Severe form	Rapid recovery.
15	Apr. 2	"	M.	6½ yrs.	(?)	60 c.c.	"	Moribund on admission	Death.
16	"	7	F.	2½ yrs.	4th	30 c.c.	"	Moribund	Death.
17	"	5	M.	14½ yrs.	4th, 5th, 6th, 7th, 8th	185 c.c.	"	Very severe form; extreme rigidity. Herpes of arm	Recovery.
18	"	14	M.	3 yrs.	9th, 10th, 11th	100 c.c.	American and Dopter	Severe form. Admitted with diagnosis of tuberculous meningitis	Rapid recovery.
19	"	14	M.	2 mos.	21st, 22nd, 23rd, 25th, 26th, 28th	105 c.c.	American	Admitted with multiple arthritis; treated by local injections	Death from marasmus. Arthritis cured.
20	"	16	M.	4½ yrs.	4th, 5th, 6th	100 c.c.	American and Dopter	Severe form	Rapid recovery.
21	"	18	M.	9 yrs.	9th, 10th, 11th	80 c.c.	"	Severe form; very purulent fluid	Rapid recovery.
22	"	18	M.	3½ yrs.	1st, 2nd, 3rd	70 c.c.	American	Treated on first day	Rapid recovery.
23	"	18	M.	9 mos.	21st, 22nd, 23rd	80 c.c.	"	Severe form	Rapid recovery.
24	"	20	M.	6½ mos.	4th, 5th, 6th, 7th, 9th, 10th	110 c.c.	"	Severe form. Infant at breast	Recovery.
25	"	25	M.	7½ yrs.	3rd, 4th, 6th, 9th	120 c.c.	"	Very severe form. Coma on admission	Rapid recovery.
26	"	29	F.	10½ yrs.	3rd, 4th, 5th	90 c.c.	"	Severe form. Admitted as appendicitis	Rapid recovery.
27	May 5	"	F.	13 yrs.	5th, 6th, 7th	120 c.c.	"	Severe form. Herpes in anal region	Rapid recovery.
28	"	7	M.	4 yrs.	21st, 22nd, 23rd, 24th, 29th	130 c.c.	"	Probable association with tuberculous meningitis	Taken home moribund.
29	"	14	F.	2 mos.	4th, 5th, 6th, 7th, 8th, 9th, 10th	145 c.c.	American and Mixed Dopter	Severe form. Morbilliform eruption	Death from marasmus.
30	"	14	M.	13 yrs.	3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th	180 c.c.	"	Vegetative endocarditis cured by intravenous injections of serum	Rapid and complete recovery.
32	"	15	F.	4 yrs.	3rd, 4th, 5th, 6th	90 c.c.	American	Severe form	Rapid recovery.
	"	18	M.	4 yrs.	45th, 46th, 47th	120 c.c.	"	Onset with morbilliform eruption. Admitted late. Cachexia; obstinate vomiting	Death.

CEREBRO-SPINAL MENINGITIS IN 1915—(continued).

Hospital Cases.

Cases.	Date.	Sex.	Age.	Day of disease of injection.	Total amount of serum injected.	Origin of serum.	Principal feature of disease.	Result.
33	May 19	F.	4 yrs.	10th, 11th, 12th, 13th	140 c.c.	American	Association with tuberculous meningitis	Death.
34	" 24	M.	3 yrs.	49th, 50th, 51st	80 c.c.	"	Very late case	Rapid recovery.
35	" 29	M.	8 yrs.	5th, 6th, 7th	100 c.c.	American and Mixed Dopter Do.	Severe case	Very rapid recovery.
36	June 7	F.	6 mos.	8th, 9th, 10th	85 c.c.	"	Severe case	Rapid recovery.
37	" 23	F.	3 yrs.	2nd, 3rd, 4th, 5th, 6th	130 c.c.	American	Severe case	Rapid recovery.

Cases in Private Practice.

1A	Jan.	M.	20 yrs.	2nd, 3rd, 4th, 5th, 6th, 7th, 8th	170 c.c.	Dopter and American	Severe form. Deafness;	Recovery; deafness.
2A	Feb.	F.	7 yrs.	3rd, 4th, 5th	120 c.c.	Mixed Dopter	Very severe form. Onset with purpura.	Death.
3A	Feb.	F.	11 yrs.	3rd, 4th, 5th	120 c.c.	"	Severe form	Rapid recovery.
4A	Mar. 22	F.	50 yrs.	5th, 6th, 7th, 8th, 9th	200 c.c.	American	Very severe form. Purpura; melancholia	Death.
5A	" 24	M.	6 yrs.	2nd, 3rd	70 c.c.	"	Very acute form. Transient blindness	Rapid recovery.
6A	April	F.	2 yrs.	2nd, 3rd, 4th	70 c.c.	"	Very grave form. Coma	Rapid recovery.
7A	April	F.	16 yrs.	6th, 7th, 8th	70 c.c.	"	Grave form	Rapid recovery.
8A	June	F.	3 yrs.	7th, 8th, 9th, 10th	150 c.c.	"	Grave form. Deafness before treatment	Rapid recovery; deafness.

to 21.9, and after eliminating 22 deaths which could not be attributed to the meningococcus, to 12.5 per cent.

Before the use of serum our mortality was 48.5 per cent. for sporadic cerebro-spinal meningitis. The mortality for epidemic cerebro-spinal meningitis in 1909 was 83.3 per cent. If the mortality had remained the same there would have been 109 fatal cases of sporadic cerebro-spinal meningitis, or 188 of epidemic meningitis. Seen under the most favourable circumstances, the number of lives saved by serum is very considerable, viz., 47 in sporadic meningitis or 116 in epidemic meningitis.

It is interesting to compare our figures with other statistics, especially those of Flexner (6), Dopter (3), E. Levy (7), and Sophian. Flexner's figures comprise 1294 cases with a mortality of 30.9; those of Levy (strictly personal like our own) comprise 165 cases with a gross mortality of 18.18, corrected to 10.06; while Sophian among 180 cases had a gross mortality of 25 per cent., corrected to 15.5 per cent.

It is right, however, to note the entirely different proportion of infants, which with us was 76 among 226 cases, or 34 per cent., with Flexner 216 among 1294, or 16.6 per cent., and with Levy 19 out of 225, or 11.5 per cent. The mortality among infants is considerably higher in spite of serum, viz., 46 per cent. in our cases, and 42.1 per cent. with Flexner and Levy. If the results are compared, after subtracting children under 2 years, our mortality is 17.3 per cent., that of Levy 16 per cent., and that of Flexner 28.6 per cent. Of the 45 cases treated by us in 1915, 34 recovered and 11 died. The mortality for 1915 was therefore 11 deaths out of 45, or 24.4 per cent.

If we wish to estimate the effects of serum treatment it is undoubtedly right not to take into account *three deaths which occurred some hours after a single injection of serum* (Cases 3, 15, and 16).

These cases cannot from any point of view be regarded as having been adequately treated. The mortality after their elimination falls to 8 out of 42 cases, or 9 per cent. Eight deaths remain, of which most, if not all, cannot be attributed to the inefficacy of the serum. In two of these cases in which the autopsy could not be carried out, the clinical course and character of the cerebro-spinal fluid suggested an *association with tuberculous meningitis* (Cases 28 and 33).

Two children died of broncho-pneumonia, which in one (Case 11) was probably tuberculous.

Marasmus was noted in two (Cases 19 and 20). These were infants aged 2 months, bottle-fed, who died with progressive emacia-

tion, and in whom the last lumbar punctures showed a clear sterile fluid.

A child, aged 4 years, died on the forty-fifth day of an unrecognised cerebro-spinal meningitis in a state of *extreme cachexia* following *obstinate vomiting* (Case 32).

A lady, aged 50 years, the subject of melancholia, who had already undergone two courses of isolation treatment, and was suffering from severe meningitis with purpura, died after receiving five injections (Case 4A).

The last death only might on close examination be attributed to inefficacy of the serum, in which case we should have a corrected mortality of 1 in 35, or less than 3 per cent.

Our results for 1915 may therefore be tabulated as follows:

Gross mortality	.	.	.	.	.	24.4 per cent.
Net	„	.	.	.	.	19 „
Corrected	„	.	.	.	.	3 „
The 180 cases prior to 1915 gave a—						
Gross mortality	.	.	.	.	.	28 per cent.
Net	„	.	.	.	.	24 „
Corrected	„	.	.	.	.	12.9 „

These figures are less favourable than those for 1915, but should not be taken too literally. The figures for 1915 have benefited by the relatively smaller number of infants, viz. 7 out of 46, instead of 69 out of 180. The prognosis of *meningitis in the infant* is considerably graver in spite of serum: 47.8 per cent. before 1915, 43 per cent. in 1915. After subtracting these cases the corrected mortality for 1915 is a little lower than before, while the gross and net mortality is a little higher.

The table of our cases treated in 1915 supplies *other proofs of the efficacy of serum treatment*.

The decline in mortality is not the only result, but there are also the attenuation of the symptoms, the rapid recovery and the rarity of complications and sequelæ.

Of 34 cases which ended in *recovery*, the latter in 24 cases was characterised as *rapid*, that is to say, that at the end of the three or four days during which the serum was injected the disease was terminated, and the only symptom which persisted, viz., rigidity, was no indication of the persistence of the meningeal infection, but merely a sign of the irritation caused by contact of the serum with the meninges (10). As a result of this rapid recovery we *never observed in our convalescents the extreme emaciation* which was noticed in previous epidemics.

There were no mental disturbances (11) or permanent paralysis. Whereas cerebro-spinal meningitis before serum treatment always caused hydrocephalus in infants in the rare cases in which it was not fatal to them, the patients of this age who recovered in 1915 showed the normal physical and mental development, and we have only two examples of hydrocephalus as compared with 37 cases of this kind which had recovered before 1915. Three patients who recovered were deaf, and will doubtless remain so. Their *deafness* preceded the first injection of serum, and there are grounds for believing that the use of serum is in many cases able to prevent this terrible complication. One child (Case 8), was affected with *irido-choroiditis* and still has visual trouble (12), but was obviously benefited by injections of serum into the vitreous.

A child who was seized with sudden blindness at the onset of meningitis, without appreciable changes in the eye, recovered her vision the day after the first injection (Case 5A).

A case of *hemiplegia* (Case 10) and one of *facial paralysis* (Case 11) noted on admission showed considerable improvement.

Intra-articular injections of serum caused a rapid cure of *suppurative arthritis* (13) (17), which in one case (Case 1A) appeared after the fourth injection, and in the other affected a large number of joints, and had been noticed before treatment had begun. The child, aged 2 months, was admitted on the twentieth day and died of marasmus. Post mortem we found that the joints, including the hips had returned to the normal.

A case of *vegetative endocarditis* noted four days after admission in a child under treatment, completely recovered after intra-venous injections (Case 30).

III. USE OF ANTI-MENINGOCOCCAL SERUM. DOSES. REPETITION OF INJECTIONS. IMPORTANCE OF EARLY DIAGNOSIS. DIFFICULTIES OF DIAGNOSIS. ADVANTAGES OF A POLYVALENT SERUM. EXPLANATION OF CERTAIN FAILURES.

We should have no difficulty in collecting statistics from other hospitals proving that anti-meningococcal serum has given as satisfactory results as our own, and even more brilliant. But we should probably not find so many cases collected by a single observer under such favourable conditions for comparison.

These successful results must undoubtedly be attributed to our method, which we have described on several occasions since 1909, here and elsewhere.

The serum must be injected in large doses, and the injections repeated

for several days in succession, for three consecutive days at least, and more if the fluid still contains meningococci.

The necessity of this procedure, which was asserted by us a long time ago, has been realised by Dunn (of Boston) (4), Robb (of Belfast), Levy (of Essen), and others; that is to say, by all the observers who have had to treat a large number of cases of meningitis.

The amount of serum injected in our cases which received complete treatment has always reached a minimum of 70 c.c., and this dose has often been exceeded (180 c.c. in Case 30, 185 c.c. in Case 17). These doses have been employed in infants as well as in other children and adults. No harm results provided care be taken never to inject a larger quantity of serum than the fluid previously withdrawn.

In 1915 we *never observed any serum phenomena* similar to those of which we spoke in our previous communications. Neither have we had any relapses since 1911 in patients who were discharged apparently cured, though we had previously observed a fairly large number of cases. This difference is certainly due to the regularity with which we continue our injections if the fluid still contains micro-organisms. This practice is unfortunately not followed by all practitioners, *many of whom give small doses of serum through fear of possible accidents or stop injecting as soon as they find a local or general improvement.* The result is that the meningococcus becomes more firmly established in less accessible regions and acquires an immunity to serum.

The serum is all the more successful the earlier the treatment is begun. Of our cases in 1915, 13 received the first injection on one of the first three days of the disease. These include only one death due to a broncho-pneumonia which was probably tuberculous. 19 patients were admitted from the fourth to the seventh day of disease; 4 of these died, and 2 arrived moribund. One infant died of marasmus. Of 11 cases who were only treated after the first week of the disease, 4 died.

It is therefore most important to make the diagnosis of cerebro-spinal meningitis as soon as possible.

We have shown that *meningitis may be suspected in the absence of classical signs.* These classical signs may be extremely transient (14), and, consequently, may be absent at the time of our examination. We shall therefore have to take into account the information furnished by persons who have been in contact with the patient.

A syncopal attack or convulsion of short duration, or rigidity lasting for a few minutes, should keep us as much on the alert as

epidemiological considerations such as arrival from a locality in which previous cases have occurred, and possible relations with possible germ carriers, like soldiers returning from well-known areas of infection.

Prominence of the fontanelles should be carefully sought for in infants in whom the symptoms are remarkably ill-developed.

Certain phenomena, which apparently have nothing to do with meningitis, especially *purpura*, a *morbilliform eruption*, *inflammation of the joints or eyes*, or a *fever of intermittent type*, may indicate a *meningococcal septicæmia*, preceding cerebro-spinal meningitis.

In every case there should be no hesitation in performing lumbar puncture on the smallest doubt, and in seeking a confirmation of one's suspicions from examination of the cerebro-spinal fluid.

This microscopical and bacteriological examination may furnish misleading information.

In certain cases the fluid is clear (16), shows only a few cells, and instead of the classical polymorphonuclears contains lymphocytes only. In other cases direct examination and cultures do not show any meningococci (18). By relying on this negative information one must be inclined to refrain from injecting serum. Such abstention may have a bad result, and our advice is to inject without delay on the least doubt.

We now come to another point on which we have not dwelt hitherto and which consequently requires a little amplification—the *nature of the serum injected*. At the time of our first communication the serums in use were all prepared in much the same manner, with hardly any difference except in their source, and in the addition or absence of antiseptics. There were the anti-meningococcal serum of Dopter and the serum of the Rockefeller Institute, which Prof. Flexner generously placed at our disposal.

At the present time we are still employing two kinds of serum: the first is a *mixed serum*, *two thirds of which consists of anti-meningococcal serum*, and *one third of Dopter's anti-parameningococcal serum*. The second is *polyvalent serum from the Laboratory of Hygiene of New York City*, which is sterilised by chloroform and not by cresyl. This serum is prepared like that of the Rockefeller Institute from animals who have been immunised with an even greater number and variety of micro-organisms.

We obviously cannot examine here in suitable detail the debated question as to the *choice between monovalent and polyvalent serums* in the treatment of numerous microbial affections. Bacteriological investigations have shown the existence of fairly marked differences

between micro-organisms of the same species, especially as regards *B. dysenteriae*, gonococci, pneumococci, etc.

Meningococci are no exception to the rule, as has been clearly shown by Elser and Huntoon (5), who, while pointing out these differences have admitted that it was merely a case of *more or less different varieties of the classical type*.

Dopter (2), to whom we are indebted for his valuable contributions to our knowledge of cerebro-spinal meningitis, believes that one may go still further, and speaks of *different species*.

He gives the name of *parameningococci* to micro-organisms with the same morphological and cultural characters and the same fermentation reactions as the meningococcus, but behaving differently in regard to agglutinins and precepitins and certain laboratory tests (peritoneum test, vein test).

These parameningococci are not destroyed by anti-meningococcal serum, but are so by an anti-parameningococcal serum obtained by immunising horses with parameningococci.

Meningeal suppuration caused in man by parameningococci is not affected by intraspinal injections of anti-meningococcal serum. It is cured, on the contrary, by injections of anti-parameningococcal serum. Anti-parameningococcal serum therefore should be substituted for anti-meningococcal serum when the latter proves ineffective, or, better still, when laboratory tests have shown that the causal microbe is a parameningococcus.

This very specious advice is, unfortunately, open to objections, which I made here in discussing the communication of MM. Widal and Weissenbach on July the 23rd, 1912, and at the Société Médicale des Hôpitaux on January the 16th, 1914, after a paper by M. Menetrier.

The patient should be given the benefit of serum treatment as soon as possible.

We have seen that the mere finding of the micro-organism sometimes requires too much time to allow waiting. A considerably longer time is required for the identification of the parameningococcus.

So it appears to us to be wiser to inject at once a serum which may simultaneously affect the meningococci and the parameningococci. If an active serum for both is not available, a mixture of serums for each separately may be injected.

But it is best to employ a polyvalent serum from the first.

I maintained that the production of a polyvalent serum of this kind was possible, and even that it had been realised.

The American serum was obtained by means of numerous doses

of meningococci differing appreciably from one another and showing, according to the investigations of Elser and Huntoon and Martha Wollstein (21), as marked differences as those between meningococci and parameningococci, and the use of this serum on patients had proved to me its efficacy. This necessity for a polyvalent serum has been made clearer still by the findings of Darré and Dumas (1), and Dopter (3), who have shown that there are *several species of parameningococci each of which requires a special serum*.

The animals supplying the American serum in present use are immunised against several different parameningococci simultaneously, and in particular against two distinct parameningococci of Dopter (Flexner). The Institut Pasteur is at present preparing on the same principles a polyvalent serum which will doubtless give us excellent results.

We will just mention injections of anti-meningococcal serum into the *lateral ventricles through the fontanelle in infants and after trephining* in older children and adults. This rational method, invented by Sladen and Cushing, has given Fischer and Levy good results. We have ourselves not yet succeeded in obtaining a definite cure by this method. On the other hand we have had good results from *injections into the joints* in suppurative arthritis, into the *vitreous* in irido-chroiditis and into the veins in meningococcal septicæmia and endocarditis. Penna (19), of Buenos Ayres, has obtained good results from exclusively intravenous injections in cerebro-spinal meningitis.

It may seem superfluous to insist on the fact that *anti-meningococcal serum can be of no avail against suppurative meningitis caused by other pathogenic agents*, especially pneumococci, streptococci, staphylococci, Pfeiffer's bacillus, etc. These forms of meningitis are not exceptional, and we have observed 8 cases this year. In the absence of bacteriological examination these cases, which all ended fatally, would have been regarded as proofs of the inefficacy of serum. It is almost certain that several medical men owe their lack of confidence in anti-meningococcal serum to the misinterpretation of cases of this kind. In conclusion we may say that anti-meningococcal serum exerts a most beneficial action on cerebro-spinal meningitis, and that thanks to its use the gravity of the disease has singularly diminished. Sufficient doses must be given, and there should be no hesitation in repeating the injection. If possible a polyvalent serum should be injected. The injections should be given as soon as possible after the onset of the disease, and an effort, therefore should be made to diagnose the case at the earliest possible

moment. Lumbar puncture should be performed on the least doubt, and it should not be forgotten that the information obtained by the microscope and cultures may sometimes not yield an immediate solution. We must, therefore, not always wait their verdict before giving the first injection.

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- (19) PENNA.—'Semana Med.,' 1913, xx, pt. 2, pp. 229 and 289.
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Royal Society of Medicine.

OBSTETRICAL AND GYNÆCOLOGICAL SECTION.

July the 1st, 1915.

The Condition of the Larynx and Trachea in the Stillborn Infant and its bearing on Artificial Respiration.—Mr. E. H. BARTON found the following condition, on examination of a number of stillborn children in whom no air had passed the glottis: For about $\frac{1}{3}$ in. below the glottis, which was invariably closed, the trachea was open, narrowing like a funnel from above down till the point was reached where the lumen was entirely obliterated by the folding in of the ends of the cartilaginous rings behind. The trachea was now flattened from before back, and where the posterior part of the rings met one another on the dorsal surface was a vertical groove. The muscular posterior wall of the trachea was folded in such a manner that by its contraction the infolded cartilage ends would be separated and an actual lumen be formed from a potential one. This condition was present to just above the bifurcation where the irregular arrangement of the cartilages pre-

vented complete apposition of the surfaces, the lumen again being filled with mucus. In a few exceptional cases the trachea was filled with mucus and open throughout its length, though flattened, suggesting that some inspiratory effort had been made which, contracting the posterior wall of the trachea, had unfolded the cartilages, even with the glottis closed. Such a condition might have occurred at the moment of birth. The thorax might be regarded as an airless, semi-rigid body, the lungs completely atelectatic and the ribs in close contact with them. Therefore at birth the thorax occupied a smaller space than it could even do after the first breath, however complete expiration was. There was some reason, too, to suppose that the ribs, after the first breath, were under an outward elastic tension, tending to expand the chest and aiding, by their outward spring, the completeness of the first inspiration. The speaker's reason for this assumption lay in the fact that on opening the chest of a child that had never breathed he had found a considerable space between the chest wall and the lungs which appeared to lie at the bottom of a definite cavity. As the airless lungs could not alter their volume this cavity must be made by releasing some tension in the chest wall itself.

The first inspiration of life was a very complicated process; the glottis must be opened, the posterior wall of the trachea must contract, and by its contraction unfold the curved cartilages, converting a closed into an open tube, the ribs under their outward tension sprang open, and air rushed into the hitherto solid lungs. The mucus in the trachea and larger bronchi was drawn into the lungs, but was too small to cause any mucus settling in the lung accompanying the first expiration. The speaker then dwelt on the bearing of these points on the judicious use of artificial respiration. To attempt to apply Sylvester's method in a child who had made no effort to breathe, or rather in whom the glottis was still closed and the trachea empty of air was waste of precious time. The glottis must be opened, the trachea surfaces separated, and then only was artificial respiration possible by methods like Sylvester's.

In many cases, especially after protracted labour, the child made no attempt at the initial inspiration. In such cases the glottis must be mechanically opened by either intubation or blowing into the child's mouth with its nose closed. Air might be drawn into the Eustachian tubes and middle ear, as well as into the stomach, but the speaker had never seen any ill results therefrom. The force used should not be great, and as soon as the lungs were distended physical or artificial respiration could be carried out easily.

Reviews.

AN INDEX OF TREATMENT BY VARIOUS WRITERS. Edited by ROBERT HUTCHISON, M.D., F.R.C.P., and JAMES SHERREN, F.R.C.S. Seventh edition. Revised and enlarged. Bristol: John Wright & Sons, 1915. Price 21s. net.

THE appearance in 1915 of the seventh edition of a medical work which was first published in 1907 is eloquent proof of its success. The articles in the present edition have been thoroughly revised and in many cases rewritten. Several new articles have been added, including those on sterility, radium-therapy, and the psychoneuroses. Mr. James Sherren has succeeded Mr. Stansfield Collier as surgical editor.

The chief writers on the medical diseases of children are Dr. F. E. Batten (cerebral palsies of childhood, poliomyelitis, and acute encephalitis), Dr. E. W. Goodall (acute infectious diseases), Dr. Leonard Guthrie (infantile convulsions, enuresis, laryngismus in childhood, head nodding, night terrors, tetany in childhood, and cyclical vomiting), Dr. Robert Hutchison (congenital pyloric stenosis, croup, dyspepsia in childhood, marasmus, infant scurvy and vulvo-vaginitis), Dr. F. J. Poynton (chorea, acute rheumatism), the late Dr. Eustace Smith (colic in children, constipation in children, infantile diarrhœa, infant feeding, vomiting in childhood), Dr. John Thomson (mental deficiency in children, rickets), and Dr. A. F. Voelcker (whooping cough). The articles on the surgery of childhood are by Dr. George Cathcart (adenoids), Mr. H. A. T. Fairbank (congenital talipes), Mr. Robert Jones (congenital dislocation of the hip, spina bifida), Mr. Robert Milne (congenital torticollis), the late Mr. Edmund Owen (tuberculous diseases of joints, caries of the spine), Mr. James Sherren (appendicitis, birth palsy, surgical treatment of congenital pyloric stenosis, intussusception), Mr. E. W. Waggett (foreign bodies in the air-passages or œsophagus), and Mr. G. E. Waugh (cleft palate, hare lip, laryngeal obstruction).

The articles are eminently practical, and, generally speaking, complete and well up to date. We notice, however, that nothing is said of the use of vaccines in the treatment of whooping cough, and we are surprised to find no mention of intramuscular injection of antitoxic serum either in the article on diphtheria or in that on specific therapy, beyond the quite erroneous statement on p. 249, that injection into muscle is more painful than into the subcutaneous tissue. We have also sought in vain for any guidance as to treatment of "carriers" in the articles on diphtheria, epidemic cerebro-spinal meningitis, or typhoid fever. These omissions have been noted in no spirit of carping criticism, but in response to the invitation of the editors in the preface, who welcome such suggestions.

The work, as a whole, deserves the highest praise, and it is indispensable to those who wish to keep abreast of the progress of modern therapeutics.

J. D. R.

TETANIA INFANTIL. Por el Dr. D. Carlos Sáinz de los Terreros. Madrid, 1915. Pp. 17.

IN this interesting monograph on infantile tetany, the writer adopts the following pathogeny of the disease. Heterologous elements are ingested in cow's milk, and a toxic substance is produced which is neutralised by the normal parathyroid secretion, but may give rise to a functional deficit in these glands. The poison then acts freely on the calcium salts, and the consequent impoverishment of the organism in these salts results in hyper-excitability of the nervous system. The treatment is to be regulated accordingly. In mild cases food containing cow's milk must be withheld for from three to six days, during which the patients should be fed on water and pap made with water. In cases of moderate severity the milk should be stopped for one to two weeks and the aforesaid diet substituted. A gradual return will then be made to milk diet. Calcium chloride should be given by mouth, and cod-liver oil should also be administered. In severe and relapsing cases a strict hydro-farinaceous diet should be ordered for a fortnight, and the return to milk should be very gradual. A calcium salt should be prescribed, preferably the chloride or bromide. A parathyroid preparation should also be added.

J. D. R.

INDEX.

- Abbott (E. G.)**, mechanics of plaster-of-Paris cast in fixed lateral curvature of spine, 285
- ABDOMEN**, care of, 218
— some acute surgical diseases of, 222
- ABSCCESS**, otitic extra-dural, two cases, 123
— retro-pharyngeal, 125
— — with rupture, asphyxiation, and death, following acute tonsillitis, 125
- ACHONDROPLASIA**, case of, 314
— pseudo-rachitic, 14
- ACIDOSIS** following diphtheria, 242
— occurrence of, in children (E. C. Williams), 327
- ACIDS** (organic), in urine of infants, 87
- ACROCEPHALOSYNDACTYLISM**, 315
- ACTINOMYCOSIS**, primary pulmonary, 121
- Adam (J.)**, Asthma and its Radical Treatment (review), 127
— infection of middle ear with Vincent's organisms, 40
- ADENITIS**, cervical, 125
— — treatment of, 317
— tuberculous, 341
— — relation of tonsils, adenoids, and other throat conditions to, 124
— of iliac fossa simulating coxalgia, 337
- ADENOIDS** and tonsils, indications for removal of, 113
— tonsils, and other throat conditions, relation of, to tuberculous cervical adenitis, 124
- ADRENAL** precocity, 281
- ADRENALIN** and pituitrin, combined treatment, 60
— solution of, in treatment of nephritis, 60
- AGENESIC** forms (congenital) of neuromuscular system, 306
- AIR-PASSAGES**, lower, and œsophagus, removal of foreign bodies from, 126
— (upper), lymphoid tissue of, relation of, to voice, 114
- ALBEE** method of bone transplantation for cure of tuberculous spine disease, 285
- ALBEE's** operation, Pott's paralysis restored by, 285
- ALBUMINURIA**, orthostatic, some experiments in connection with, 88
- ALIMENTARY** diseases due to defect, researches on, 338
- Allyn (H. B.)**, insufficiency of pulmonary valve, 181
- Almond (G. H. H.)**, myositis ossificans (juvenile progressive type), 283
- ALOPECIA** areata, epidemic, case, 28
- Amante and Pepa**, diphtheria in infant, aged 15 days, 18
- Amenta (F.)**, pulmonary sclerosis, 123
- AMENTIA** in association with pseudo-hypertrophic muscular dystrophy, case, 145
- AMYOTONIA** congenita, 282
- ANÆMIA**, blood-pressure in, in infancy, 181
— splenic infantile, ætiology of, 179
— with enlargement of spleen; splenectomy; cure, 179
- Andréoli (G.)**, prognosis of typhoid fever in children in Paris hospitals, 25
- ANGINA** (Vincent's), 348
- ANTERIOR** chamber, cysts in, arising from pars ciliaris retinæ, 157
- ANTI-SYPHILITIC** treatment, splenomegaly improved by, 13
- ANTITOXIN** (diphtheria), intravenous injection of, 245
- AORTA**, perforation of arch of, by safety-pin impacted in œsophagus (E. G. L. Goffe), 44
- ? **AORTIC** disease, 48
- APNŒA**, two cases, 123
- APPENDICITIS**, chronic, 221
- APPENDICULAR** abscess in infant, 313
- APPENDIX**, vermiform, congenital inguinal implantation of, 221
- Arnott (J. H.)**, and **Fetterolf (G.)**, case of Sprengel's deformity, 223
- Aron (H.)**, and **Franz (M.)**, organic acids in urine of infants, 87
- ARTERIAL** trunk, common persistent, in infant, aged 6 months, 182
- ARTERY**, pulmonary, atheroma of, and extreme dilatation of right ventricle in association with cardiac failure in a child, aged 6 years (P. J. Veale and Carey Coombs), 72
- ARTHRITIS** deformans and Still's disease, relation between, 27
— and gonococcus septicæmia following scarlet fever, 245
— polyarticular, chronic, case of, 145
— syphilitic, case of, 29
- ASCARIS**, expulsion of, in appendicular form of pneumonia, two cases, 123
- Ashby (H. S.)**, case of cerebellar abscess in child not arising from ear trouble, 105
— case of myelitis, 142

- Askins (R. A.)**, present position of ophthalmology in school hygiene, 187
- ASPHYXIA** and continued fever, tendency of constitutional whooping-cough to, 248
- ATAXIA**, acute, and encephalitis, 309
- ATELECTASIS** and enlarged thymus, case, 281
- ATHEROMA** of pulmonary artery and extreme dilatation of right ventricle in association with cardiac failure in child, aged 6 years (P. J. Veale and Carey Coombs), 72
- Atkinson (E.)**, fatal case of meningitis associated with influenza-like bacillus, 93
- ATLAS**, rotary dislocation of, case, 287
- ATRESIA**, labyrinthitis following operation for, 347
- recto-vesicalis, 56
- ATROPHY** of infants and congenital lesions of liver in newly-born, 52
- Aubert and Leuret (G.)**, case of abscess of lung or interlobar tissue, evacuated through bronchi, cured by artificial pneumothorax, 122
- AUDITORY** apparatus, tuberculosis of; internal hydrocephalus; permanent drainage of lateral ventricle (C. E. West), 171
- Austregesilo and Esposel**, case of achondroplasia, 314
- Babinski (J.)**, *Exposé des Travaux Scientifiques de* (1913) (review), 288
- Babler (E. A.)**, cavernous and cystic lymphangioma of cæcum, 220
- BACILLEMIA**, primary tuberculous, 341
- BACILLI** (Koch's) and meningococcal meningitis, 93
- Bacillus aerogenes capsulatus*. See *Bacterium Welchii*.
- of bovine tubercle as factor in phlyctenular affections of eye, 156
- *bulgaricus*, diarrhœa treated with culture of, 61
- *coli*, infections of, 89
- *dysenterix* septicæmia, case, 249
- (influenza-like), fatal case of meningitis associated with, 93
- *tuberculosis*, culture of, from blood, post mortem, of case of miliary tuberculosis, 120
- BACTERÆMIA**, otitic pneumococcus, 347
- BACTERIA** in throat and nose, use of kaolin for removal of, 349
- Bacterium Welchii* (*Bacillus aerogenes capsulatus*) occurrence of, in dejecta of children, 153
- Bailey (W. C.)**, diagnosis and treatment of tuberculosis, 117
- Baldwin (J. F.)**, adrenal precocity, 281
- Ba (C. A.)**, congenital pyloric stenosis in infant, treated by gastro-enterostomy, 218
- Barber (H. W.)**, urticaria papulosa, 251
- and **Saner (F. D.)**, enlarged liver, 85
- Barbier (H.)**, broncho-alveolitis, 342
- tuberculosis of liver, 343
- and **Cléret (M.)**, atrophy of infants and congenital lesions of liver of newly-born, 52
- Barbosa**, case of syphilitic arthritis, 29
- Barker (D. S.)**, use of blood-serum of immunes in treatment of malignant scarlatina, 59
- Barrett (J. B.)**, chronic appendicitis, 221
- Bartlett (F. H.)**, persistent vomiting associated with rumination, 215
- and **Wollstein (M.)**, study of tuberculous lesions in infants and young children based on post-mortem examination, 340, 341
- Barton (E. A.)**, condition of the larynx and trachea in stillborn infants, and its bearing on artificial respiration, 366
- Batten (F. E.)**, and **Jukes (M. A.)**, amaurotic family idiocy (Waren Tay-Sachs disease), 241
- and **Mayou (S.)**, cerebral degeneration associated with macular changes, 158
- and **von Wyss (W. H.)**, atonic form of cerebral diplegia, 65
- — atonic form of cerebral diplegia (Foerster), case, 143
- Baxter (J. M.)**, prenatal corneal opacities, 156
- Beekman**, precocious maturity in girls, 282
- Beifeld (A. F.)**, and **Elliott (C.)**, generalised neuro-fibromatosis (von Recklinghausen's disease), 305
- Benedict (F. G.)**, and **Talbot (F. B.)**, gaseous metabolism of infants, 152
- Bennett (R. H.)**, case of lympho-sarcoma with bacterial findings, 56
- BENZOL** in treatment of chronic lymphoid leukaemia causing much temporary benefit, case (H. D. and J. D. Rolleston), 33
- Berestad (G.)**, what is the cause of "physiological loss of weight of newly-born children?" 51
- Beretta (A.)**, significance of prenatal eruption of teeth, 212
- Berkowitz (S.)**, and **Huber (F.)**, primary pulmonary actinomycosis, 121
- Berry (C. W.)**, some cases of diarrhœa treated with culture of *Bacillus bulgaricus*, 61
- Berry (G.)**, labyrinthitis following operation for atresia, 347
- BETA-OXYBUTYRIC** acid determination in recurrent vomiting, 215

- BILE** salts and pigments in urine, relation of, to hæmokonina, 337
- Binet (A.), and Simon (T.),** Mentally Defective Children (review), 160
- BIOMETRIC** and eugenic studies of elementary school-children (J. F. Halls Dally), 184
- Bittner,** acute typhoidal inflammation of the gall-bladder, 25
- Blackfan (K. S.), and Thomas (H. M.),** recurrent meningitis due to lead, 311
- Blakeway (H.),** operative treatment of cleft palate, 313
- Blechmann (G.),** epigastric route for pericardiac paracentesis, 183
- (and others), comparison of results of luetin reaction and reaction of Wassermann in hereditary syphilis, 29
- BLADDER,** ectopia of, 56
- BLOOD** of children, cholesterin contents in, 177
- in pertussis, 177
- (post mortem), culture of *B. tuberculosis* from, in case of miliary tuberculosis, 120
- transfusion of, in treatment of purpura hæmorrhagica, 57
- — (direct), in treatment of hæmorrhagic disease of newborn, 57
- BLOOD-FINDINGS** in melæna neonatorum, 53
- BLOOD-PRESSURE** in anæmia in infancy, 181
- in normal children, 180
- BLOOD-SERUM** of immunes, use of, in treatment of malignant scarlatina, 59
- BLOOD-STREAM,** *Treponema pallidum* found at autopsy in, in case of congenital syphilis, 254
- Bókay (Z. von),** persistent common arterial trunk in infant, aged 6 months, 182
- BONE** lues, early congenital, 254
- BONE** plastic operation on spine for cure of Pott's disease, results of, 347
- transplantation (Albee method) for cure of tuberculous spine disease, 285
- BONE-SPLINT** transplantation in recurrent spondylolisthesis with paralysis, 285
- BONES** and joints, tuberculosis of, major varieties of, 119
- Bookman (A.),** metabolism in osteogenesis imperfecta, with special reference to calcium, 314
- Borell (R. W.),** case of chondro-osteosarcoma, amputation at hip, 317
- BRACHIAL** plexus, removal of outer part of imperfect right clavicle relieving severe symptoms from pressure on, in case of cleido-cranio-dysostosis, 14
- Bradley (W. N.),** congenital deformity of both hands and feet, 315
- deformity of hands and feet, 16
- BRADYCARDIA** and tachycardia, 183
- BRAIN,** degeneration of, associated with macular changes, 158
- symptoms, localising, as early events in tuberculous meningitis (C. O. Hawthorne), 232
- tuberculous tumours of, 309
- Brandeis (J. W.),** polydactylism as a hereditary character, 315
- Brav (A.),** congenital phthisis bulbi, 158
- BREAST-MILK** (human), skimmed, feeding of, 148
- Broca (A.), and Houdré (M.),** tetanus inoculated by felt employed in correction of scoliosis by Abbott's method, 26
- Brodie (W. D.), and Goltz (E. V.),** use of living lactic acid bacilli in diphtheritic throats, 59
- Bromley (L.),** tumour of the upper extremity of the femur, 11
- BRONCHI,** abscess of lung or interlobar tissue evacuated through, cured by artificial pneumothorax, 122
- BRONCHIAL** glands, infantile, in tuberculosis, healing process of, 118
- — and lung hilus, tuberculosis of, 118
- BRONCHITIS,** recurrent, 121
- BRONCHO-ALVEOLITIS,** case, 342
- BRONCHOGENOUS** infection with tuberculosis in infancy, 119
- BRONCHO-PNEUMONIA,** lobar form of, of long duration, occurring in children and young adults, 122
- Brouwer (B.), and Schippers (J. C.),** amyotonia congenita, 282
- Bunch (J. L.),** generalised ichthyosis, 48
- ichthyosis associated with long-standing superficial ulceration of tongue, 143
- keratosis follicularis spinulosa, 15
- nine patches of morphœa, 48
- Bundesen (H. N.),** Schick reaction, 243
- Butler (E. M.), and Jeans (P. C.),** hereditary syphilis as social problem, 255
- Butzner (J. D.),** spasmodic ileus simulating intussusception, 220
- Bythell (W. J. S.),** hernia of stomach through diaphragm in child, aged 9 years, 236
- Cabrera,** on diphtheria, 18
- Cadwalader (W. B.),** progressive lenticular degeneration, 309
- CÆCUM,** cavernous and cystic lymphangioma of, 220
- CAFFEINE** and strychnine as cardio-vascular stimulants in acute infectious diseases, 184
- CAGLIARI,** relative frequency of Mongoloid marks among infantile population of, 351
- Cailliau and Variot,** congenital labial hemispasm and malformation of ears, 338

- CALCIUM**, deficient retention of, in osteogenesis imperfecta, 314
- CALORIC** diet, high, in typhoid fever, 248
- Cameron (H. C.)**, Diet and Disease in Infancy (review), 351
- Campbell (J. M.)**, pulmonary tuberculosis in children, 198
- Cappelli (J.)**, hereditary epidermolysis bullosa and congenital pemphigus, 250
- CARDIO-CIRRHOSIS**, tuberculous, case, 342
- CARDIO-VASCULAR** troubles in scarlet fever, 20
- CARCINOMA**, ovarian, in child, aged 11 years, 318
- Carling (E.)**, tuberculosis in children, 116
- Caronia (G.)**, ætiology of infantile splenic anæmia, 179
- and **di Cristina (G.)**, treatment of Leishmaniosis, 178
- CARRIERS** of diphtheria bacillus, 19
- CATARRH** (bronchial, chronic), and dermatitis herpetiformis, case, 252
- CATHETERISATION** (duodenal), in feeding of infants, 216
- Cautley (E.)**, case of pulmonary regurgitation, 143
- deformity and wasting of hands with deformity of feet, 144
- ectromelus with absence of pectoral muscles on right side, 144
- CEREBELLUM**, absence of, not arising from ear trouble (H. T. Ashby), 105
- CEREBRO-SPINAL** fever, see *Meningitis* (cerebro-spinal).
- Chalier and Pêhu**, congenital tuberculosis, 339
- — inheritance of tuberculosis, 339
- Chancellor (P. S.)**, hemiparesis and hemiplegia as early symptoms in tuberculous meningitis, 344
- CHANCRE**, primary extra-genital, of wrist, case (G. Pernet), 296
- Chapin (H. D.)**, typhoid fever, 248
- Charlton (C. C.)**, retro-pharyngeal abscess with rupture, asphyxiation, and death, following acute tonsillitis, 125
- Chatelin and Zuber**, case of pseudo-meningocele, 311
- CHEST**, congenital transposition of stomach to left side of, 213
- Chiaravallotti (L.)**, fibro-myxo-sarcoma of mesentery, 318
- CHOLESTERIN** contents in blood of children, 177
- CHONDRODYSPLASIA**, hereditary deforming, 314
- CHONDO-OSTEO-SARCOMA**, amputation at hip, case, 317
- CHOREA**, voice sign in, 311
- CHOROIDITIS**, congenital syphilis, syphilis meningo-vascularis, optic atrophy, herpes zoster, multiple root lesions (L. Guthrie and E. G. Fearnside), 206
- CIRCUMCISION** in masturbation of female infants, 89
- Clark (H. C.)**, and **Gates (I. N.)**, *Treponema pallidum* found at autopsy in bloodstream and elsewhere in cases of congenital syphilis, 254
- CLAVICLE** (imperfect right) removal of outer part of, relieving severe symptoms from pressure on brachial plexus in case of cleido-cranio-dysostosis, 14
- CLEFT** palate, operative treatment of, 313
- Cléret (M.)**, and **Barbier (H.)**, atrophy of infants and congenital lesions of liver of newly born, 52
- Climenko (H.)**, dystonia musculorum deformans, 284
- CLUB-FOOT**, congenital, 16
- double, in twins, 316
- Coates (G. M.)**, jackstones impacted in œsophagus; three cases; one death, 126
- Coccyx**, dislocation of, 16
- Cockayne (E. A.)**, sclerodermia with congenital contractures and other defects, 144
- Coe (H. C.)**, metrorrhagia at puberty, 282
- Cole (H. N.)**, and **Ruh (H. O.)**, pemphigoid of newborn (pemphigus neonatorum), 51
- Cole (Rufus T.)**, pneumococcus infection and immunity, 80
- Collett (A.)**, case of general paralysis, 30
- Colliver (J. A.)**, cutaneous regional variation in the Pirquet reaction, 345
- obscure manifestations of rheumatism, 27
- COLON**, dilatation of, in myatonia congenita, case, 49
- Comby (J.)**, acute encephalitis, 337
- three cases of tetanus cured by subcutaneous injections of anti-tetanic serum, 1
- vulvo-vaginitis, 89
- COMPLEMENT-DEVIATION** test in diagnosis of whooping-cough, 24
- COMPLEMENT** fixation test in management of gonococcus vulvo-vaginitis, 90
- Concetti (L.)**, congenital agenesis forms of the neuro-muscular system, 306
- CONJUNCTIVA**, lymphangioma of (E. M. Maxwell), 335
- CONJUNCTIVAL** affections, chronic, causes and treatment of, 156
- Connell (R.)**, two cases of Schlatter's sprain, 288
- CONSTIPATION** and other diseases of infants, uses of petroleum in, 61
- CONTRACTURES**, congenital, and other defects, sclerodermia with, 144
- CONVULSIONS** during pertussis, 248
- in intestinal putrefaction, 218

- Coombs (Carey), and Veale (P. J.)**, cardiac failure in a child, aged 6 years, associated with atheroma of pulmonary artery and extreme dilatation of right ventricle, 72
- CORNEAL** opacities, prenatal, 156
- Coughlin (W. T.)**, sarcoma of tongue, 218
- COXA** vara, 287
- — — adolescentium traumatica, 287
- COXALGIA** simulated by adenitis of iliac fossa, 337
- Cozzolino (O.)**, Mongoloid markings on ventral aspect of the body, 250
- relative frequency of Mongoloid marks among infantile population of Cagliari, 251
- Grandall (F. M.)**, endocarditis, 183
- CRETINISM**, 16
- di Cristina (G.)**, and **Caronia (G.)**, treatment of Leishmaniasis, 178
- CRUS** cerebri, tumour of, 307
- Curgenwen (J. Sadler)**, The Child's Diet (review), 31
- CUTI-REACTION** in experimental tuberculosis, 344
- CYANOSIS**, congenital, without auscultatory signs, 181
- CYSTS** in anterior chamber arising from pars ciliaris retinae, 157
- Dally (J. F. Halls)**, biometric and eugenic studies of elementary school-children, 184
- Davidson (A. J.)**, Pott's paralysis; restoration by Albee's operation, 285
- Davies (H. M.)**, and **Poynton (F. J.)**, case of cleido-cranio-dysostosis in which removal of outer part of imperfect right clavicle relieved severe symptoms from pressure on brachial plexus, 14
- Davis (B. F.)**, acrocephalosyndactylism, 315
- Davis (E. D.)**, importance of very thorough examination in cases of foreign body alleged to have been swallowed or inhaled, 126
- Davis (H.)**, epidemic alopecia areata, 28
- DEAFNESS** following mumps, 347
- DEATH** of children during labour, cause of, 51
- DEFORMITIES**, rachitic, unusual, 15
- DEJECTA** of children, occurrence of *Bacterium Welchii* (*Bacillus aerogenes capsulatus*) in, 153
- Delavan (D. B.)**, employment of skiagraphy in diagnosis of thymus gland, 281
- Delépine (S.)**, milk supply as a causal factor in relation to tuberculosis, 117
- DENTAL** clinics, 189
- DERMATITIS** herpetiformis and chronic bronchial catarrh, case, 252
- — — with tuberculous glands of neck, 252
- DERMATOGENOUS** infection with tuberculosis in infancy, 119
- DERMOIDS** (inclusion) of pharynx, 349
- DIABETES** in early infancy, 90
- insipidus with infantilism, 12
- mellitus, three cases in one family, 91
- DIAPHRAGM**, hernia of stomach through, (W. J. S. Bythell), 236
- DIAARRHŒA** (heat and summer), 154
- (infantile summer), frequency of *Proteus vulgaris* in, 154
- — — prognostic value of Schmidt's test in, 154
- infectious, 154
- treated with culture of *Bacillus bulgaricus*, 61
- Dickson (E. C.)**, subacute atrophy of liver, 217
- DIETETICS** of eczema, 252
- DIGESTION**, gastric, in infants, 213
- (infant), disturbances in, significance of mineral salts in (C. T. Wood), 151
- — — influence of starch upon, 151
- DIPHThERIA**, 18
- analysis of 62 fatal cases of, 244
- bacilli, carriers of, 19
- carriers of (chronic), 59
- — — treatment of, 59
- — — use of vaccines in, 59
- cerebral embolism of, 49
- complicated by purpura, 87
- effect of lactic acid bacilli upon, 59
- followed by acidosis, 242
- in infant, aged 15 days, 18
- in Metropolitan Asylums Board Hospitals, 18
- incidence of, in relation to defective drainage, 242
- pericarditis in, 241
- primary bronchial, case (W. Mitchell Smith), 331
- rare complications of, 242
- tracheal casts in, 350
- Schick toxin reaction for immunity in, 176
- of skin, 27
- DIPLEGIA** (cerebral), atonic form of (F. E. Batten and W. H. von Wyss), 65
- — — — case (E. G. Fearnside), 166
- — — — (Foerster), case, 143
- spastic, 16
- DIVERTICULUM**, Meckel's, inverted intussusception caused by, 220
- Dodd, (W. G.)**, Röntgen ray in tuberculosis, 117
- Douglas (R.)**, large myeloid of mandible, 218
- Dubourg (E.)**, tuberculous and meningococcal or parameningococcal meningitis, 94
- Du Boys (P. L.)** and **Neal (J. B.)**, streptococcus meningitis, 310
- DUCTLESS** glands, diseases of, 279

- Dunn (C. H.)**, diagnosis and prognosis of congenital heart disease, 182
 — fat indigestion in infants, 152
DUODENUM, ulcer of, in infancy, 216
Dragoesco (V.), general atrophy in heredo-syphilis without apparent syphilitic lesions, 29
DRAINAGE, defective, incidence of diphtheria in relation to, 242
Drysdale (H. H.), juvenile psychosis, 313
Dykes (A. L.), incidence of diphtheria in relation to defective drainage, 242
DYSTONIA musculorum deformans, 284
DYSTROPHY, muscular, pseudo-hypertrophic, associated with amentia, case, 145
EAR, diseases of, economic importance of, in school-children, 188
 — (middle), infection of, with Vincent's organisms (J. Adam), 40
EARS, malformation of, and congenital labial hemispasm, 338
Eckert (H.), Ursache und Wesen angeborener Diathesen. Eine experimentelle Studie. (The Origin and Nature of Inborn Diathesis: an Experimental Study) (review), 64
ECTHYMA gangrænosum in measles, 247
ECTRODACTYL, case, 240
ECTROMELUS with absence of pectoral muscles on right side, 144
ECZEMA, causes and treatment of, 28
 — dietetics of, 252
EDINBURGH, tuberculous milk in, 117
Edmunds (A.), ectopia of bladder, 56
EDUCATION of children with defective vision (N. Bishop Harman), 257, 289
 — otology in relation to, 123
Ehrenfried (A.), multiple cartilaginous exostoses—hereditary deforming chondrodysplasia, 314
EIWEISSMILCH of Finkelstein and Meyer, observations on, 150
Elliott (C. A.) and **Beifeld (A. F.)**, generalised neuro-fibromatosis (von Recklinghausen's disease), 305
Ely (L. W.), double club-foot in twins, 316
EMBOLISM, cerebral, diphtheria in, 49
EMPHYSEMA (generalised subcutaneous) in uncomplicated measles, 21
ENCEPHALITIS, acute, 337
 — and acute ataxia, 309
ENDOCARDITIS, 183
 — infective, chronic, 183
 — rheumatic, out-patient treatment of, 60
Engle (R. L.), progressive muscular atrophy, 111
ENTEROGENOUS infection with tuberculosis in infancy, 119
ENTROPION, congenital, 156
EPIDERMOLYSIS bullosa (hereditary) and congenital pemphigus, 250
EPIGASTRIC route for pericardiac paracentesis, 183
EPILEPTIC children, one hundred and seventy-five, study of ætiology in, 312
EPIPHYSIS of small trochanter of femur, separation of, 288
EPIPHYSITIS, tuberculous, 317
ERUPTIVE fevers, vaccinal allergy in, 22
ERYTHEMA nodosum, association of, with tuberculosis, 119
 — with facial paralysis and hemiplegia, 251
Esposel and **Austregesilo**, case of achondroplasia, 314
ETHMOIDITIS, acute, causing orbital abscess with optical neuritis, 158
EUGENICS in elementary school-children, studies of, 184
Evans (W.), talipes equinus, 316
 — tuberculous epiphysitis, 317
Eves (C. C.), teratoma of pharynx, 125
EXOSTOSES, multiple cartilaginous (hereditary deforming chondrodysplasia), 314
EYE, phlyctenular affections of, bacillus of bovine tubercle as factor in, 156
EYES, diseases of, and pediculosis of scalp, relation between, 157
Faber (H. K.), culture of *B. tuberculosis* from the blood, post mortem, of case of military tuberculosis, 120
 — tuberculous meningitis complicated by influenzal meningitis, 93
FÆCES, infants', reaction of iodine to, 153
Fairbanks (A. W.), study of ætiology in one hundred and seventy-five epileptic children, 312
FARINACEOUS food, intolerance of, in infant, aged 10 months, 338
Farrell (B. P.), Hibbs' osteoplastic operation for Pott's disease, 284
Fassett (F. J.), and **Manning (J. B.)**, Still's disease and arthritis deformans, 27
FAT, absorption of, from intestinal tract of actively tuberculous child, 118
 — indigestion in infants, 152
Favre-Gilly (A.), and **Péhu (M.)**, typhoid fever with regular course in infant, aged 7 months, 25
Fearnside (E. G.), case of atonic form of cerebral diplegia, 166
 — — chronic polyarticular arthritis, 145
 — — pseudo-hypertrophic muscular dystrophy associated with amentia, 145
 — — infantile hemiplegia, 136
 — and **Guthrie (L.)**, syphilis meningo-vascularis, congenital syphilis, chorooiditis, optic atrophy, herpes zoster, multiple root lesions, 206
Fedde (B. A.), retro-pharyngeal abscess, 125
Fedele (N.), treatment of nephritis with adrenalin solution, 60

- Fedorovsky (W.)**, tracheal casts in diphtheria, 350
- FEEDING** of infants, duodenal catheterisation in, 216
- — with top milk, 149
- — undiluted citrated milk in, 149
- the newborn, 147
- of skimmed breast-milk, 148
- FEET**, deformity of, and deformity and wasting of hands, 144
- and hands, deformity of, 16
- — — (congenital), case, 315
- FELT** employed in correction of scoliosis by Abbott's method, tetanus inoculated by, 26
- FEMUR**, epiphysis of small trochanter of, separation of, 288
- osteo-sarcoma of, 16
- tumour of upper extremity of, 11
- Ferreira (C.)**, Mongolian blue spots at São Paulo, 251
- Fetterolf (G.)** and **Arnott (J. H.)**, case of Sprengel's deformity, 223
- FEVER**, continued, and asphyxia, tendency of constitutional whooping-cough to, 248
- FIBRO-MYXO-SARCOMA** of mesentery in infant, 318
- FIBULA**, left, congenital absence of, 224
- Figdor (P.)**, pericarditis in diphtheria, 241
- Figueira (F.)**, salt fever and sugar fever in pædiatrics, 151
- Filia (A.)**, cholesterolin contents in blood of children, 177
- Findlay (L.)**, use of neo-salvarsan in mental deficiency, 256
- and **Robertson (M. E.)**, some manifestations of congenital syphilis, 253
- Fischer (L.)**, case of hypernephroma, 281
- convulsions during pertussis, 248
- Fishberg (M.)**, cutaneous tuberculin test in children of non-tuberculous parentage, 345
- Fisher (E. D.)**, Landry's paralysis, 305
- FISTULA**, parotid, following mastoid operation, 124
- Fitzgerald (J. G.)**, fatal case of rabies, 249
- Fleitas (J.)**, cretinism, 16
- Flexner (S.)**, mode of infection and ætiology of epidemic poliomyelitis, 302
- Foerster (O. H.)**, association of erythema nodosum and tuberculosis, 119
- Fonzo (F.)**, death during lumbar puncture, 91
- Forbes (F. G.)**, discussion on rheumatic infections in relation to school life, 186
- Ford (W. W.)** and **Knox (J. H. M., jun.)**, occurrence of *Bacterium Welchii* (*Bacillus aerogenes capsulatus*, in dejecta of children, 153
- FOREIGN** bodies, removal of from œsophagus and lower air-passages, 126
- FOREIGN** body alleged to be swallowed or inhaled, importance of thorough examination in cases of, 126
- Fowler (J. S.)**, nutritive diseases of infancy, 152
- FRAGILITAS** ossium, 157
- Francioni (C.)**, acute yellow atrophy of liver, 216
- François and Schreiber (G.)**, infantile scorbutus in child fed on homogenised milk, 151
- Frank (F.)**, acute nephritis in infancy from disturbances of nutrition, 88
- Franz (M.)** and **Aron (H.)**, organic acids in urine of infants, 87
- Fraser (J.)**, major varieties of bone and joint tuberculosis, 119
- tuberculous cervical adenitis, 341
- Fraser (J. S.)**, otology in relation to infectious fevers, public health, and education, 123
- two cases of otitic extra-dural abscess, 123
- Fraser (K.)**, early pulmonary tuberculosis in childhood, 116
- Frazer (W. T.)**, significance of von Pirquet's test, 344
- Freeman (R. G.)**, causes and treatment of eczema, 28
- Freeman (R. J.)**, circumcision in the masturbation of female infants, 89
- French (T. R.)**, tonsillotomy *versus* tonsillectomy, 135
- Frescoln (L. D.)** and **Knowles (F. C.)**, diphtheria of the skin, 27
- Friedenwald (E. B.)** and **Greenfeld (W.)**, tuberculous tumours of brain, 309
- Friedlander (A.)** and **Wagner (E. A.)**, diagnosis of whooping-cough by the complement-deviation test, 24
- FRIEDREICH'S** disease with spastic phenomena, 10
- Friel (A. R.)**, *Obiter Scripta*, Throat, Nose, and Ear (review), 31
- GALL-BLADDER**, acute typhoidal inflammation of, 25
- Gandier and Wery**, thymectomy, 314
- GANGRENE**, multiple, case of, 28
- GASTRIC** secretions in infants, effects of sugars upon, 151, 213
- GASTRO-ENTERITIS** complicated by œdema, 176
- (acute), of newly-born, sea-water (Quinton's plasma) by ingestion in, 60
- GASTRO-ENTEROSTOMY** for congenital pyloric stenosis, pylorus after, 219
- in treatment of congenital pyloric stenosis in infant, 218
- Garland (F. E.)** and **Greene (D. C.)**, removal of foreign bodies from œsophagus and lower air-passages, 126

- Garnier and Havelacque**, typhoid cerebro-spinal meningitis in newborn infant, 91
- Gates (T. N.) and Clark (H. C.)**, *Treponema pallidum* found at autopsy in bloodstream and elsewhere in case of congenital syphilis, 254
- Gauvain (H. J.)**, Lord Mayor Treloar Cripples' Hospital and College, Alton, Hampshire (review), 352
- Gavis (M. C. de)**, remarks on whooping-cough with especial reference to asphyxia and continued fever (or constitutional whooping-cough), 248
- GENITAL** origin of streptococcal peritonitis, 222
- Ginsberg (G.)**, and **Graef (C.)**, Schick test, 244
- di Giorgio (G.)**, forty-one cases of infantile Leishmaniosis observed at pædiatric clinic at Palermo in scholastic year, 1912-13, 178
- Girard (L.) and Méry (H.)**, generalised subcutaneous emphysema in uncomplicated measles, 21
- GLANDS** (tuberculous), of neck, in dermatitis herpetiformis, 252
- Godlewski (H.) and Triboulet (H.)**, seawater (Quinton's plasma) by ingestion in acute gastro-enteritis of newborn, 60
- Goffe (E. G. L.)**, case of syndactyly of left hand with constriction of right forearm, 240
- four cases of ichthyosis in family of six children, 143
- perforation of arch of aorta by safety-pin impacted in œsophagus, 44
- pericarditis from case of scarlet fever, 50
- GOITRE**, exophthalmic, in child of 8½ years, 338
- Goldmann**, cause of death of children during labour, 51
- Goltz (E. Y.) and Brodie (W. D.)**, use of living lactic acid bacilli in diphtheritic throats, 59
- Gordon (A.)**, internal pachymeningitis, 94
- some features of pneumococcus meningitis, 310
- unusual form of birth palsy, 307
- Gordon (M. H.)**, Report of, to Local Government Board on an Experimental Investigation in Relation to Mumps or Epidemic Parotitis (review), 32
- Gow (A. E.) and Thursfield (H.)**, splenomegaly; splenectomy, 179
- Graef (C.) and Ginsberg (G.)**, Schick test, 244
- GRAFT** operation on spine for cure of Pott's disease, results of, 347
- Graham (E. E.)**, osteosarcoma of femur, 16
- treatment of pertussis, 58
- Grandjean**, congenital cyanosis without auscultatory signs, 181
- Grasty (T. S. D.)**, influenzal meningitis, 93
- Graves (L. E.)**, congenital transposition of stomach to left side of chest, 213
- Green (R. M.)**, intracranial hæmorrhage in newborn, 53
- transfusion in treatment of hæmorrhagic disease of newborn, 57
- Greene (D. C.) and Garland (F. E.)**, removal of foreign bodies from œsophagus and lower air-passages, 126
- Greenfeld (W.) and Friedenwald (E. B.)**, tuberculous tumours of brain, 309
- Griffith (J. P. C.)**, typhoid fever in early life, 25
- GROIN**, hygroma of, 55
- Grupee (C. G.)**, laboratory diagnosis in early stages of congenital syphilis, 254
- and **Harms (F.)**, tuberculosis as disease in newborn, 339
- and **Lewis (D.)**, the pylorus after gastro-enterostomy for congenital pyloric stenosis, 219
- Guinon (L.)**, encephalitis and acute ataxia, 309
- and **Halbron**, meningitic syndrome supervening on varicella in adenopathic child, 338
- GUMS**, hypertrophy of, 49
- Gunson (E. B.)**, child with tooth erupted at birth, 10
- oculo-cardiac reflex, 97
- pericarditis in scarlet fever, 50
- purpura complicating diphtheria, 87
- suprarenal hæmorrhage, 86
- Güntzer (J. H.)**, orbital abscess with optical neuritis due to acute ethmoiditis, 158
- Guthrie (L.)**, tuberculoma of the pons Varolii; pulmonary tuberculosis in a boy, aged 3½ years; death, necropsy, remarks, 225
- and **Fearnside (E. G.)**, syphilis meningo-vascularis, congenital syphilis, choroiditis, optic atrophy, herpes zoster, multiple root lesions, 206
- HÆMATOMA** of lower lid in infant, aged 5 months, unusual manifestation of infantile scurvy (S. Stephenson), 77
- HÆMOKONIA**, relation of, to bile salts and pigments in urine, 337
- HÆMORRHAGE**, in newborn, 53
- intracranial, in newborn, 53
- cerebral, 307
- supra-renal, 86
- HÆMORRHAGES**, recurrent severe, in late childhood, 337
- HÆMORRHAGIC** disease of newborn, treatment of, by direct transfusion of blood, 57

- Hahn (M.)**, erythema nodosum with facial paralysis and hemiplegia, 251
 — gastric digestion in infants, 213
Hahn (R.) and **Knöpfelmacher (W.)**, return cases of scarlet fever, 21
Halbron and **Guinon**, meningitic syndrome supervening on varicella in adenopathic child, 338
Hamill (S. M.), palate deformity, 16
Hammond (P.), parotid fistula following mastoid operation, 124
Hancock (C. R.), intussusception caused by inverted Meckel's diverticulum, 220
HANDS and feet, deformity of, 16
 — — — (congenital), case, 315
 — deformity and wasting of, with deformity of feet, 144
Harding (H. W.), acidosis following diphtheria, 242
Harman (N. Bishop), congenital entropion, 156
 — cure of squint, 159
 — education of children with defective vision, 257, 289
Harms (F.) and **Grulee (C. G.)**, tuberculosis as disease of newborn, 339
Harper (J.), Vincent's angina, 348
Hartshorn (D. M.) and **Moeller (H. N.)**, vaccine treatment in pertussis, 58
Hartshorn (W. M.), *Bacillus coli* infections, 89
Hauxwell (F.), control and treatment of scabies, 253
Havelacque and **Garnier**, typhoid cerebrospinal meningitis in newborn infant, 91
Hawthorne (C. O.), acholuric jaundice, 15
 — hemiplegia, onset sudden, but without convulsions, no evidence of visceral disease, 239
 — localising brain symptoms (hemiplegia and hemispasm), as early events in tuberculous meningitis, 232
 — paramyoclonus multiplex, 15
HEARING, conservation of, 123
HEART, disease of, congenital, diagnosis and prognosis of, 182
 — — — and ulcerative sore throat, 85
 — — — — — (J. D. Rolleston), 274
 — failure of, in child, aged 6 years, associated with atheroma of pulmonary artery and extreme dilatation of right ventricle (P. J. Veale and Carey Coombs), 72
HEART-BLOCK, two cases, 11
 — congenital (T. R. Whigham), 321
Heiman (H.), parapharyngeal abscess as distinguished from retropharyngeal and peritonsillar abscesses, 348
 — refractory or so-called "fast" cases of meningococcus meningitis, 92
Hektoen (L.) and **Rappaport (B.)**, use of kaolin to remove bacteria from throat and nose, 349
HEMIMELIA thoracica, 223
HEMIPARESIS and hemiplegia as early symptom in tuberculous meningitis, 344
HEMIPLEGIA and facial paralysis in erythema nodosum, 251
 — and hemiparesis as early symptoms, in tuberculous meningitis, 344
 — and hemispasm as early events in tuberculous meningitis (C. O. Hawthorne), 232
 — infantile, 307
 — — case of (E. G. Fearnside), 136
 — onset sudden, but without convulsions, no evidence of visceral disease, 239
HEMISPASM, congenital labial, and malformation of ears, 338
 — and hemiplegia as early events in tuberculous meningitis (C. O. Hawthorne), 232
Henick (F. C.), atresia recto-vesicalis, 56
Henkin (A. L.), pemphigus foliaceus neonatorum, 250
HEREDO-SYPHILIS, general atrophy in, without apparent syphilitic lesions, 29
HERNIA of stomach through diaphragm, case (W. J. S. Bythell), 236
HERNIAL sac, tuberculosis of, 221
HERPES zoster, optic atrophy, choroiditis, congenital syphilis, syphilis meningovascularis, multiple root lesions (L. Guthrie and E. G. Fearnside), 206
Herrman (C.), feeding the newborn, 147
 — measles, incubation, infectivity, immunity, early manifestations, 246
Hess (A. F.), duodenal catheterisation and feeding in infants, 216
 — German measles, an experimental study, 22
 — pylorus, pylorospasm, and allied spasms in infants, 214
 — vaccines in prophylaxis and treatment of pertussis, 58
Heublein (A. C.) and **Stoll (H. F.)**, tuberculosis of the bronchial glands and lung hilus, 118
HIBBS' osteoplastic operation for Pott's disease, 284
Higgins (T. T.), ovarian sarcomata in children, an account of three cases, 161
 — and **Poynton (F. J.)**, teratoma of pharynx, 87
Hildesheim (O.), The Health of the Child (review), 352
Hill (H. K.), liquid paraffin in infants, 175
HIP, amputation at, for chondro-osteosarcoma, case, 317
 — dislocation of, congenital, reduction of, before second year, 338
HIRSCHSPRUNG'S disease, 221
Hogan (J. F.) and **Nicholson (S. T.)**, effect of lactic acid bacilli on diphtheria, 59
Holden (O.), Still's disease, 27

- Holt (L. Emmett)**, some manifestations of influenza, 122
- Home** and school life, co-ordination of (H. R. Kenwood), 185
- Hoobler (B. R.)**, experiment in collection of human milk for hospital and dispensary work, 148
- Houdré (M.)** and **Broca (A.)**, tetanus inoculated by felt employed in correction of scoliosis by Abbott's method, 26
- Huber (F.)**, pneumococcic meningitis and meningismus, 92
- and **Berkowitz (S.)**, primary pulmonary actinomycosis, 121
- Hudson (A. C.)**, pediculosis of scalp and eye disease, 157
- Hutchison (R.)**, hypertrophy of gums, 49
- Hydrocephalus**, 311
- internal, and tuberculosis of auditory apparatus; permanent drainage of lateral ventricle (C. E. West), 171
- and spina bifida with deformity of legs, 147
- Hygroma axillare** and **hygroma cysticum colli**, 54
- cystic, 55
- of groin, 55
- Hypernephroma**, case, 281
- Hypopituitarism**, case, 241
- clinical and metabolic studies of case, 280
- Ichthyosis** associated with long-standing superficial ulceration of tongue, 143
- generalised, 48
- four cases of, in family of six children, 143
- Icterus** (epidemic), 217
- Idiocy**, amaurotic family (Waren Tay-Sachs disease, 241
- Mongolian, and syphilis, connection between, 255
- Infectious diseases**, acute, use of strychnine and caffeine as cardio-vascular stimulants in, 184
- Ileus**, spasmodic, simulating intussusception, 220
- Iliac fossa**, adenitis of, simulating coxalgia, 337
- Imperatori (C. J.)**, case of otitic meningitis due to *Streptococcus capsulatus*, 123
- Index** of Prognosis and End-Results of Treatment (review), 350
- of Treatment by various writers (review), 367
- Indigestion**, see *Fat indigestion*.
- Infantilism** in diabetes insipidus, 12
- Infectious fevers**, otology in relation to, 123
- Influenza**, bone manifestations of, 122
- Inguinal implantation**, congenital, of vermiform appendix, 221
- Intestinal obstruction**, congenital, 313
- due to sigmoid volvulus, 314
- putrefaction with convulsions, 218
- tract of actively tuberculous child, absorption of fat from, 118
- Intussusception** caused by inverted Meckel's diverticulum, 220
- in infancy, danger of delay in diagnosis and treatment of, 219
- simulated by spasmodic ileus, 220
- Insanity** in children, 312
- Iodine**, reaction to, of infants' fæces, 153
- Jackstones** impacted in œsophagus, three cases, one death, 126
- Jacobs (C. M.)**, bone transplantation (Albee method) for cure of tuberculous spine disease, 285
- Jaundice** (acholuric), 15
- (hæmolytic congenital) with splenomegaly, cholesterol metabolism in, case of, 217
- Jeanneret (D. L.)**, La Tuberculose de l'Enfant; Traitement de ses formes médicales et chirurgicales par la Tuberculine (review), 224
- Jeans (P. C.)** and **Butler (E. M.)**, hereditary syphilis as social problem, 255
- and **Veeder (B. S.)**, diagnosis and treatment of late hereditary syphilis, 255
- Joints** and bones, tuberculosis of, major varieties of, 119
- Johnes (H. R.)** and **Sherman (De W.)**, effect of sugars on the gastric secretions in infants, 151, 213
- Jones (E. C.)** and **Meine (B. M.)**, chronic infective endocarditis, 183
- Jopson (J. H.)**, congenital elevation of the scapula, 17
- Jordán (J. A.)**, acute Malta fever meningitis, 92
- Joseph (B.)**, rhinolith of several years' duration, 124
- Jousset (A.)**, primary tuberculous bacillæmia, 341
- Joyane (A.)**, hitherto undescribed form of chronic meningitis, 94
- Judson (C. F.)** and **Nicholson (P.)**, blood-pressure in normal children, 180
- Jukes (M. A.)** and **Batten (F. E.)**, amaurotic family idiocy (Waren Tay-Sachs disease), 241
- Kaolin**, use of, to remove bacteria from throat and nose, 349
- Kahn (L. M.)**, pneumococcus peritonitis, 222
- some acute surgical diseases of abdomen, 222
- Kauffmann (I.)** and **Landis (H. R. M.)**, diagnosis of tuberculosis in early life, 117

- Kaupe (W.)**, hypertrophy of the thymus and Röntgen rays, 61
- Kellock (T. H.)**, case of double osteotomy of tibiae ten years after operation, 212
— form of self-mutilation of penis in young boys, 209
- Kelynack (T. N.)**, tuberculosis in childhood, 340
- Kenwood (H. R.)**, the school and the home, 185
- KERATOSIS follicularis spinulosa**, 15
- Kerley (C. G.)**, one hundred and forty-one cases of recurrent vomiting, 215
— recurrent bronchitis, 121
— What Every Mother should know (review), 351
- Kerr (J.)**, discussion on rheumatic infections in relation to school life, 186
- KIDNEYS**, lymphocytomatosis or lymphoblastomatosis of (F. Parkes Weber), 268
- Kirkpatrick (T. P. C.)**, lupus pernio, 253
- KNEE-JERK**, excessive, in infantile paralysis, 85
- Knopf (S. A.)**, water in prevention and cure of tuberculosis, 346
- Knöpfelmacher (W.) and Hahn (R.)**, return cases of scarlet fever, 21
- Knowles (F. C.)**, molluscum contagiosum, 15
— pellagra in childhood, 175
— and **Frescoln (L. D.)**, diphtheria of skin, 27
- Knott (Y. B.)**, ovarian carcinoma in child, aged 11 years, 318
- Knox (J. H. M., jun.)**, diabetes in early infancy, 90
— and **Ford (W. W.)**, occurrence of *Bacterium Welchii* (*Bacillus aerogenes capsulatus*) in dejecta of children, 153
- Kolmer (J. A.) and Moshage (E. L.)**, Schick toxin reaction for immunity in diphtheria, 176
- Krumwiede (C., jun.)** (and others), attempts to produce scarlet fever in monkeys, 19
- Kuth (J. R.)**, early congenital bone lues, 254
- LABOUR**, cause of death of children during, 51
- LABYRINTHITIS** following operation for atresia, 347
- LACTIC acid**, bacilli of, effect of, on diphtheria, 59
— — — (living), use of, in diphtheritic throats, 59
— — — presence of, in urine in cyclic vomiting, 88
- Ladd (W. E.)**, treatment of cervical adenitis, 317
- La Fetra (L. E.) and Schroeder (L. C.)**, high caloric diet in typhoid fever, 248
- Landis (H. R. M.)**, relation of the tonsils to tuberculosis, 111
- Landis (H. R. M.) and Kauffmann (I.)**, diagnosis of tuberculosis in early life, 117
- Lange**, reduction of congenital dislocation of hip before second year, 338
- Langmead (F.)**, case of hypopituitarism, 241
— discussion on rheumatic infections in relation to school life, 186
— pseudo-rachitic achondroplasia, 14
- LARYNGO-PHARYNGEAL** stenosis in pulmonary tuberculosis, 342
- LARYNX** and trachea, condition of, in still-born infants, bearing of, on artificial respiration, 366
- Lassalle (M.)**, two cases of the appendicular form of pneumonia with expulsion of an ascaris, 123
- LEAD**, recurrent meningitis due to, 311
- Le Boutillier (S.)**, unusual rachitic deformities, 15
- LEGS**, deformity of, hydrocephalus and spina bifida with, 147
- LEISHMANIOSIS**, infantile, forty-one cases of, observed at pædiatric clinic at Palermo in scholastic year 1912-13, 178
— treatment of, 178
- LENTICULAR** degeneration, progressive, 309
- Lespinasse (Y. D.)**, treatment of hæmorrhagic disease of newborn by direct transfusion of blood, 57
- LEUKÆMIA**, lymphatic, acute, 178
— lymphoid, chronic, benzol treatment in, causing much temporary benefit, case (H. D. and J. D. Rolleston), 33
- Leuret (E.)**, remarks on weaning, 147
- Leuret (G.) and Aubert**, case of abscess of lung or interlobar tissue evacuated through bronchi cured by artificial pneumothorax, 122
- Levi**, abortive scarlet fever in first months of life, 245
- Lewis (D.) and Grulee (C. G.)**, the pylorus after gastro-enterostomy for congenital pyloric stenosis, 219
- LID**, lower, hæmatoma of, in infant, aged 5 months, unusual manifestation of infantile scurvy (S. Stephenson), 77
- LIMBS**, contraction of, and defective patellæ, case for diagnosis, 239
- Lind (W. L. S.)**, case of juvenile general paralysis of the insane, 30
- Litchfield (W. F.)**, analysis of 62 fatal cases of diphtheria, 244
— two cases of apnoea, 123
- LIVER**, abscess of, case, 50
— — — in infant (C. Violet Turner), 107
— acute atrophy of, 86
— — — yellow atrophy of, 216
— congenital lesions of, and atrophy of infants, in newly-born, 52
— enlarged, case, 85
— subacute atrophy of, 217

- LIVER, tuberculosis of, in infant, aged 3 months, 343
- Lorenzini (A.)**, case of mucous plug in rectum in newborn infant, 52
- Loubet** (and others), meningococcal meningitis and Koch's bacilli, 93
- Lövegren (E.)**, blood-findings in melæna neonatorum, 53
- Low (R. C.)**, case of generalised vaccinia, 247
- Lowenberg (H.)**, infantile syphilis, 15
- Lower (W. E.)**, Hirschsprung's disease, 221
- Lucas (W. P.)** and **Wentworth (M. H.)**, out-patient treatment of rheumatic endocarditis, 60
- LUES**, hereditary, of nervous system (Friedreich's symptom complex), 29
- LUTIN** reaction and Wassermann reaction in hereditary syphilis, comparison of results of, 29
- in pædiatrics, value of, 255
- LUMBAR** puncture, death during, 91
- in newborn, 52
- spinal abscess communicating with lung, case, 317
- LUNG** hilus and bronchial glands, tuberculosis of, 118
- lumbar spinal abscess communicating with, case, 317
- or interlobar tissue, abscess of, evacuated through bronchi, cured by artificial pneumothorax, 122
- LUPUS** pernio, case, 253
- vulgaris, 252
- Lyman (G. D.)**, dietetics of eczema, 252
- LYMPH** cyst of mesentery, case, 56
- glands, tuberculosis of, bacteriological study of, 117
- LYMPHANGIOMA** (cavernous and cystic) of cæcum, 220
- congenital, situated over sternum, 318
- cystic, case, 239
- of conjunctiva (E. M. Maxwell), 335
- LYMPHOCYTOMATOSIS** or lymphoblastomatosis, especially of kidneys (F. Parkes Weber), 268
- LYMPHOID** tissue of upper air-passages, relation of, to voice, 114
- LYMPHO-SARCOMA** with bacterial findings, case, 56
- Mabbott (J. H.)**, infant feeding with top milk, 149
- Maccone (L.)**, frequency of *Proteus vulgaris* in infantile summer diarrhœa, 154
- McCleave (S. C.)**, relation of bovine tuberculosis to early tuberculosis, 118
- MacEwan (J. A. C.)**, congenital lymphangioma situated over sternum, 318
- McGlannan (A.)**, intestinal obstruction due to sigmoid volvulus, 314
- McGowan (A. G.)**, hæmorrhage in newborn, 53
- McKee (J. H.)**, Practical Pediatrics (review), 61
- McKelyry (J. P.)** and **Rosenbloom (J.)**, cholesterol metabolism in case of congenital hæmolytic jaundice with splenomegaly, 217
- McKendrick (J. S.)**, anæmia with enlargement of spleen; splenectomy; cure, 179
- Mackenzie (G. W.)**, case with open safety-pin in œsophagus, 126
- McLellan (S. W.)**, incidence of pulmonary tuberculosis in children, 115
- McWalter (J. C.)**, case of enlarged thymus and atelectasis, 281
- MACULA**, changes in, in association with cerebral degeneration, 158
- Maggiore (S.)**, significance of certain areas of thoracic dulness, 342
- Maillet and Nobécourt**, hæmokonia and the bile salts and pigments in urine, 337
- Makuen (G. H.)**, relation of the lymphoid tissue of the upper air-passages to the voice, 114
- MALNUTRITION**, occurrence of tuberculous infection in young children in cases of, 116
- MALTA** fever, see *Meningitis* (acute Malta fever).
- MANDIBLE**, large myeloid of, case, 218
- Mann (H. C.)**, undiluted citrated milk in infant feeding, 149
- Manning (J. B.)** and **Fassett (F. J.)**, Still's disease and arthritis deformans, 27
- MARASMUS**, treatment of, by high doses of sugar, 60
- Marie and Weill**, clinical form of tuberculous meningitis beginning with paralysis of oculo-motor nerve, 159
- Marquis (G. P.)**, post-operative antiseptic treatment of tonsillar fossæ, 349
- Marsh (N. P.)**, acute lymphatic leukæmia, 178
- Martin (J. C.)**, trichotillomania, 312
- MASTOID** operation followed by parotid fistula, 124
- MASTURBATION** of female infants, circumcision in, 89
- MATURITY**, precocious, in girls, 282
- Mauriac and Philip**, meningeal conditions in scarlet fever and scarlatinal uræmia, 20
- Maxwell (E. M.)**, lymphangioma of conjunctiva, 335
- Mayou (S.)** and **Batten (F. E.)**, cerebral degeneration associated with macular changes, 158
- MEASLES**, ecthyma gangrænosum in, 247
- (German), see *Rubella*.
- in Metropolitan Asylums Board Hospitals, 21

- MEASLES**, incubation, infectivity, immunity, early manifestations, 246
 — uncomplicated, generalised subcutaneous emphysema in, 21
- MEDICAL** and Surgical Reports of the Episcopal Hospital (review); 31
- MEDICAL** Annual Synoptical Index to Remedies and Diseases (review), 320
- MEDICAL** Annual: A Year-book of Treatment and Practitioner's Index, 1915 (review), 256
- MEGALERYTHEMA**, infective, with Rumpel-Leede phenomenon, case, 245
- Meine (B. M.)** and **Jones (E. C.)**, chronic infective endocarditis, 183
- MELÆNA** neonatorum, 53
 — blood-findings in, 53
- Mellon (R. R.)**, early diagnosis of streptococic sore throat and the effect of vaccines in its treatment, 349
- MENINGEAL** conditions in scarlet fever and scarlatinal uræmia, 20
- "**MENINGISMUS**" and pneumococic meningitis, 92
- MENINGITIS** (cerebro-spinal), bacteriology of (D. Nabarro), 193
 — — — incomplete, 92
 — — — present epidemic of, efficacy of anti-meningococcal serum in (A. Netter), 353
 — — — typhoid, in newborn infants, 19
 — chronic, hitherto undescribed form of, 94
 — fatal case of, associated with influenza-like bacillus, 93
 — influenzal, 93
 — — tuberculous meningitis complicated by, 93
 — Malta fever, acute, 92
 — (meningococcal) and Koch's bacilli, 93
 — — refractory or so-called "fast" cases of, 92
 — otitic, due to *Streptococcus capsulatus*, case, 123
 — pneumococcal, 310
 — — and meningismus, 92
 — — some features of, 310
 — recurrent, due to lead, 311
 — streptococcus, 310
 — symptoms of, supervening on varicella in adenopathic child, 338
 — tuberculous and meningococcal or parameningococcal, 94
 — — clinical form of, beginning with paralysis of oculo-motor nerve, 159
 — — complicated by influenzal meningitis, 93
 — — hemiparesis and hemiplegia as early symptom in, 344
 — — hemiplegia and hemispasm as early events in (C. O. Hawthorne), 232
- MENINGOCELE**, rare complication of whooping-cough, 24
- MENTAL** deficiency, use of neo-salvarsan in, 256
 — diseases and nervous diseases, 305
- Méry (H.)** and **Girard (L.)**, generalised subcutaneous emphysema in uncomplicated measles, 21
- MESENTERIC** glands, tubercular and retroperitoneal, pre-operative diagnosis of, 343
- MESENTERY**, fibro-myxo-sarcoma of, in infant, 318
 — lymph cyst of, 56
- METABOLISM** (cholesterol), in case of congenital hæmolytic jaundice with splenomegaly, 217
 — (gaseous) of infants, 152
 — in osteogenesis imperfecta, with special reference to calcium, 314
- Metcalf (C. R.)**, separation of epiphyses of small trochanter of femur, 288
- METROPOLITAN** Asylums Board Hospitals, diphtheria in, 18
 — — — measles in, 21
 — — — scarlet fever in, 19
 — — — whooping-cough in, 23
- METRRORRHAGIA** at puberty, 282
- Middleton (A. B.)**, round worm within body of tonsil, 348
- Midelton (W. J.)**, dermatitis herpetiformis and chronic bronchial catarrh, 252
 — — — with tuberculous glands of neck, 252
- Milhit** and **Nobécourt** cardio-vascular troubles in scarlet fever, 20
- MILK** (cow's) raw and heated, 149
 — homogenised, infantile scorbutus in child fed on, 151
 — human, collection of, for hospital and dispensary use, experiment in, 148
 — (sterilised) effect of, on rickets, 150
 — supply as causal factor in relation to tuberculosis, 117
 — (top) infant feeding with, 149
 — tuberculous, in Edinburgh, 117
 — (undiluted citrated), in infant feeding, 149
- Miller (C. H.)**, pyloric obstruction in infants, 214
- Miller (H. R.)**, treatment for diphtheria carriers, 59
- Miller (R.)**, case of inherited syphilis with Wassermann reactions, 144
- Milligan (Sir W.)**, laryngeal papillomata, 350
- Mitchell (A. P.)**, bacteriological study of tuberculosis of the lymph glands, 117
 — incidence of tuberculosis in childhood, 115, 340
 — infection of children with the bovine tubercle bacillus, 117
 — tuberculous milk in Edinburgh, 117
- Mixer (C. S.)**, case of lymph cyst of mesentery, 56

- Modigliani (E.)**, observations on the 'Eiweissmilch' of Finkelstein and Meyer, 150
- Moeller (H. N.) and Hartshorn (D. M.)**, vaccine treatment in pertussis, 58
- MOLLUSCIOUS** tumours, extensive pigmented and hairy naevus with, case (W. Mitchell Smith), 299
- MOLLUSCUM** contagiosum, 15
- MONGOLIAN** blue spots at São Paulo, 251
- MONGOLOID** markings on ventral aspect of body, 250
— marks, relative frequency of, among infantile population of Cagliari, 251
- MONKEYS**, attempts at production of scarlet fever in, 19
- MONTESSORI** system of education of children with defective vision, 257
— — — — (L. Paton), 129
- MONSTROSITY**, twin, of third week of embryonic life, 51
- Moody (E. E.)**, intradermic diphtheria toxin test, 244
- Moore (C. G.)**, three cases of diabetes mellitus in one family, 91
- MORPHEA**, nine patches of, 48
- Morquio (L.)**, pneumococcal meningitis, 310
- Morrison (J. T.)**, tuberculosis of hernial sac, 221
- Morse (J. L.)**, clinical and sociological aspects of whooping-cough, 23
— infantile scorbutus, 150
— infectious diarrhoea, 154
- and Wyman (E. T.)**, blood-pressure in anæmia in infancy, 181
- Morton (J. J.)**, case of rotary dislocation of the atlas, 287
- Moshage (E. L.) and Kolmer (J. A.)**, Schick toxin reaction for immunity in diphtheria, 176
- Mosher (E. M.)**, care of the abdomen, 218
- Mott (W. W.)**, cerebral hæmorrhage, 307
- Mouret and Péhu**, acute general tuberculosis in infant, 120
- Mouriquand and Weill**, researches on alimentary diseases due to defect, 338
- Mucous** plug in rectum in newborn infant, 52
- Mumford (A. A.)**, estimation of physique and stamina for school purposes, 185
- MUMPS** followed by deafness, 347
- MUSCLES**, diseases of, 282
— pectoral, absence of, on right side, ectromelus with, 144
- MUSCULAR** atrophy, progressive (R. L. Engle), 111
- MYATONIA** congenita of Oppenheim, 282
— — with dilatation of colon, case, 49
- MYELITIS**, case of (H. T. Ashby), 142
- MYELOID**, large, of mandible, case, 218
- Myers (B.)**, splenomegaly improved by anti-syphilitic treatment, 13
- "**MYOPE** classes" in education of children with defective vision, 262
- MYOPES**, occupations for, 295
- MYOSITIS** ossificans following single trauma, 283
— — juvenile progressive type, 283
- Nabarro (D.)**, on the bacteriology of cerebro-spinal fever, 193
- Nadel and Nobécourt**, results of feeding sick children on 10 per cent. saccharose, 338
- NÆVUS** (giant), case, 12
— (extensive, pigmented, and hairy) with molluscous tumours, case (W. Mitchell Smith), 299
- Nash (J. S. C.)**, Evolution and Disease (review), 190
- NATIONAL** Association for the Prevention of Consumption and other Forms of Tuberculosis, Transactions of (review), 127
- Neal (J. B.) and Du Boys (P. L.)**, streptococcus meningitis, 310
- Neave (S.)**, infantile paralysis with excessive knee-jerk, 85
- NECK**, congenital malformation of, 54
— tuberculous glands of, in dermatitis herpetiformis, 252
- Neff (F. C.)**, feeding of skimmed breast-milk, 148
- NEO-SALVARSAN**, use of, in mental deficiency, 256
- NEPHRITIS**, acute, in infancy, from disturbances of nutrition, 88
— chronic infantile, mild forms of, 88
— treatment of, with adrenalin solution, 60
- NERVE**, oculo-motor, paralysis of, clinical form of tuberculous meningitis beginning with, 159
— (optic) atrophy, choroiditis, congenital syphilis, syphilis meningo-vascularis, herpes zoster, multiple root lesions (L. Guthrie and E. G. Fearnside), 206
- NERVOUS** diseases and mental diseases, 305
— system, hereditary lues of (Friedreich's symptom complex, 29
- Netter (A.)**, the efficacy of anti-meningococcal serum in the present epidemic of cerebro-spinal meningitis, 353
— incomplete cerebro-spinal meningitis, 92
- Neuhof (H.)**, congenital elevation of scapula (Sprengel's deformity) of familial type, 222
- NEURITIS**, optical, accompanying orbital abscess due to acute ethmoiditis, 158
- NEURO-FIBROMATOSIS** (generalised) (von Recklinghausen's disease), 305
- NEURO-MUSCULAR** system, congenital agenesic forms of, 306
- NEWBORN**, feeding of, 147

- Newburgh (L. H.)**, use of strychnine and caffeine as cardio-vascular stimulants in acute infectious diseases, 184
- Nicholson (F. D.)**, experiments in connection with orthostatic albuminuria, 88
- Nicholson (P.)** and **Judson (C. F.)**, blood-pressure in normal children, 180
- Nicholson (S. T.)** and **Hogan (J. F.)**, effect of lactic acid bacilli on diphtheria, 59
- Nicoll (M., jun.)**, gonococcus and septicæmia with arthritis following scarlet fever, 245
- Nicolussi (O.)**, case of purpura fulminans, 253
- NIGHT** terrors, cause and cure of, 312
- Nisenon**, some observations on the last epidemic of scarlet fever in Warsaw, 19
- Nobécourt (P.)**, treatment of vomiting infants and of marasmus by high doses of sugar, 60
- and **Maillet**, hæmokoniasis and the bile salts and pigments in urine, 337
- and **Milhit**, cardio-vascular troubles in scarlet fever, 20
- and **Nadel**, results of feeding sick children on 10 per cent. saccharose, 338
- and **Philippon**, intolerance of farinaceous food in infant of 10 months, 338
- Nose** and throat, use of kaolin to remove bacteria from, 349
- NUTRITION**, acute nephritis in infancy from disturbances of, 88
- diseases of, in infancy, 152
- Nutt (J. J.)**, results of bone plastic and graft operations on the spine for the cure of Pott's disease, 347
- O'Brien (C. M.)**, lupus vulgaris, 252
- OCULO-CARDIAC** reflex (E. B. Gunson), 97
- Oden (R. J. E.)**, hydrocephalus, 311
- ŒDEMA**, complicating gastro-enteritis, 176
- unexplained, and pemphigus in convalescence from scarlet fever, case of (R. Loy Wilcox), 9
- ŒSOPHAGUS**, jackstones impacted in, three cases, one death, 126
- and lower air-passages, removal of foreign bodies from, 126
- open safety-pin in, case, 126
- perforation of arch of aorta by safety-pin impacted in (E. G. L. Goffe), 44
- Oliver (P.)**, myositis ossificans following a single trauma, 283
- Olmedo (P.)**, typhoid periostitis, 316
- OPHTHALMIA** neonatorum, and infection of adults, anti-gonococcal vaccine in, 57
- OPHTHALMOLOGY**, present position of, in school hygiene, 187
- ORBIT**, abscess of, with optical neuritis due to acute ethmoiditis, 158
- Orsi-Battaglini (E.)**, cuti-reaction in experimental tuberculosis, 344
- OSTEOGENESIS** imperfecta, metabolism in effect of on calcium retention, 314
- OSTEO-SARCOMA** of femur, 16
- OSTEOTOMY**, double, of tibiæ, ten years after operation, 212
- Ostheimer (M.)**, fragilitas ossium, 157
- OTOLOGY** in relation to infectious fevers, public health and education, 123
- retrospect of, 1914 (M. Yearsley), 109
- Ottow**, twin monstrosity of third week of embryonic life, 51
- D'Ovidio**, laminar desquamation of skin in newborn, 51
- PACHYMEINGITIS**, internal, 94
- Packard (F. R.)**, indications for the removal of tonsils and adenoids, 113
- PALATE**, deformity of, 16
- PALERMO**, pædiatric clinic at, forty-one cases of infantile Leishmaniosis observed at, in scholastic year 1912-13, 178
- PALSY** (birth), unusual form of, 307
- PANCREAS**, suprarenals and thymus in children, relation between, 279
- Panting (L. C.)**, cystic hygroma, 55
- PAPILLOMATA**, laryngeal, 350
- PARACENTESIS** (pericardiac), epigastric route for, 183
- PARAFFIN**, liquid, for infants, 175
- PARALYSIS** (facial), and hemiplegia in erythema nodosum, 251
- general, case, 30
- — (juvenile), of insane, case, 30
- infantile, with excessive knee-jerk, 85
- (Landry's), 305
- of oculo-motor nerve, clinical form of tuberculous meningitis beginning with, 159
- Pott's, restoration by Albee's operation, 285
- recurrent spondylolisthesis with, bone-splint transplantation, 285
- PARAMYOCLONUS** multiplex, 15
- PARAPHARYNGEAL** abscess as distinguished from retropharyngeal and peritonsillar abscesses, 348
- PARATYPHOID** fever, 26
- PARESIS**, juvenile, treated by intra-spinal injection of salvarsanised serum, 30
- PARIS**, hospitals of, prognosis of typhoid fever in, 25
- Park (W. H.)**, transmission of tuberculosis in childhood, 340
- (and others), Schick reaction and its practical applications, 243
- Parker (C. A.)**, congenital malformation of neck, 54
- Parker (W. S.)**, beta-oxybutyric acid determinations in recurrent vomiting, 215
- Parkinson (J. Porter)**, acute atrophy of liver, 86

- Parkinson (J. Porter)**, Friedreich's disease with spastic phenomena, 10
— suppurative parotitis following pneumonia, 141
- PAROTID** glands, seasonal enlargement of, 14
- PAROTITIS**, suppurative, following pneumonia (J. Porter Parkinson), 141
- PARS** ciliaris retinæ, cysts in anterior chamber arising from, 157
- PATELLÆ** (defective), and contraction of limbs, case for diagnosis, 239
- Paterson (E. W.)**, purpura hæmorrhagica treated by blood-transfusion, 57
- Paton (L.)**, Montessori education for children with defective sight, 129
- Pearson (J. S.)**, prognostic value of Schmidt's test in summer diarrhœa of infants, 154
- PEDICULOSIS** of scalp and eye disease, relation between, 157
- Péhu (M.)**, and **Chalier**, congenital tuberculosis, 339
— — inheritance of tuberculosis, 339
— and **Mouret**, acute general tuberculosis in infant, 120
— and **Favre-Gilly (A.)**, typhoid fever with regular course in infant, aged 7 months, 25
- PELLAGRA** in childhood, 175
— in early childhood, 28
- PEMPHIGOID** of newborn (pemphigus neonatorum), 51
- PEMPHIGUS**, acute, complicating scarlet fever (J. M. Robertson-Ross), 7
— (congenital) and hereditary epidermolysis bullosa, 250
— foliaceus neonatorum, 250
— and unexplained œdema in convalescence from scarlet fever, case (R. Loy Wilcox), 9
- PENIS**, form of, self-mutilation of, in young boys (T. H. Kellock), 209
- Pepa** and **Amante**, diphtheria in infant, aged 15 days, 18
- PERICARDITIS** in diphtheria, 241
— specimens from cases of scarlet fever, 50
- PERIOSTITIS**, typhoid, 316
- PERITONEAL** complications of scarlet fever, 19
- PERITONITIS** (pneumococcal), 222
— (streptococcal) of genital origin, 222
- Pernet (G.)**, case of extra-genital primary chancre of the wrist, 296
- PERTUSSIS**, ætiology of, 23
— blood in, 177
— convulsions during, 248
— treatment of, 58
— vaccines in prophylaxis and treatment of, 58
- Peterson (E. W.)**, danger of delay in diagnosis and treatment of intussusception in infancy, 219
- PETROLEUM**, uses of, in treatment of constipation and other diseases in infants, 61
- Pfaundler (M.)** and **Schlossmann (A.)**, Diseases of Children: a Work for the Practising Physician, edited by (review), 318
- PHARYNX**, inclusion dermoids of, 349
— teratoma of, 87, 125
- Phélip**, appendicular abscess in infant, 313
- PHILADELPHIA** Pediatric Society, Proceedings, 15, 111, 175, 302, 313
- Philip** and **Mauriac**, meningeal conditions in scarlet fever and scarlatinal uræmia, 20
— and **Trèves**, acute influenzal thyroiditis and Pott's disease, 317
- Philippon** and **Nobécourt**, intolerance of farinaceous food in infant, aged 10 months, 338
- PHLYCTENULAR** affections of eye, bacillus of bovine tubercle as factor in, 156
- PHTHISIS** bulbi, congenital, 158
- PHYSIQUE** and stamina, estimation of, for school purposes, 185
- Pieri (G.)**, tuberculous vaginalitis, 343
- PIGMENTS** and bile salts in urine, relation of, to hæmokia, 337
- PINEAL** gland insufficiency in children, 280
- von Pirquet (C.)**, bronchogenous, placentogenous, dermatogenous, and enterogenous infection with tuberculosis in infancy, 119
- VON PIRQUET'S** test, cutaneous regional variation in, 345
— significance of, 344
- PITUITARY** and adrenalin, combined treatment with, 60
- PLACENTOGENOUS** infection with tuberculosis in infancy, 119
- PLASTER-OF-PARIS** cast, mechanics of, in fixed lateral curvature of the spine, 285
- Platt (H.)**, case of lumbar spinal abscess communicating with the lung, 317
- Plomley (M. J.)**, case of infantile tetany, 312
- PNEUMOCOCCUS**, infection by, and immunity from (Rufus S. Cole), 80
— see also *Peritonitis*, pneumococcal.
- PNEUMONIA**, appendicular form of, with expulsion of ascaris, two cases, 123
— followed by suppurative parotitis (J. Porter Parkinson), 141
- PNEUMONIAS**, atypical, of infancy and childhood, 122
- PNEUMOTHORAX**, case of, 146
— artificial, abscess of lung or interlobar tissue cured by, 122
- POLIO-ENCEPHALITIS** with ocular manifestations only, 85
- POLIO-ENCEPHALOMYELITIS**, case, 240

- POLIOMYELITIS** (epidemic), mode of infection and aetiology of, 302
- Pollock (W. B. Inglis)**, education of semi-blind, 188
- POLYDACTYLISM** as hereditary character, 315
- PONS Varolii**, tuberculoma of, and pulmonary tuberculosis, death, necropsy (L. Guthrie), 225
- POTT's disease** and acute influenzal thyroiditis, 317
- bone plastic and graft operations on spine for cure of, results of, 347
- **Hibbs' osteoplastic operation** for, 284
- Poynton (F. J.)**, ? aortic disease, 48
- discussion on rheumatic infections in relation to school life, 186
- and **Davies (H. M.)**, case of cleidocranio-dysostosis in which removal of outer part of imperfect right clavicle relieved severe symptoms from pressure on brachial plexus, 14
- and **Higgins (T. T.)**, teratoma of pharynx, 87
- (and others), inclusion dermoids of pharynx, 349
- study of rheumatic infection, 26
- Priestley (J.)**, sex distribution of rickets, 173
- true aim and purpose of routine inspection of children in school, 184
- Pritchard (E.)**, case of pneumothorax, 146
- case of polio-encephalomyelitis, 240
- cystic lymphangioma, 239
- **Infant Nutrition and Management** (review), 63
- uses of petroleum in treatment of constipation and other diseases of infants, 61
- and **Turner (E. V.)**, case of liver abscess in infant, 50
- PROTEUS vulgaris**, frequency of, in infantile summer diarrhoea, 154
- PSEUDO-MENINGOCELE**, case of, 311
- PSYCHOSIS**, juvenile, 313
- PULMONARY** valve, insufficiency of, 181
- PULSATING** tumour of scalp, 49
- PUPIL**, dilated, of Argyll-Robertson type, 157
- PURPURA** complicating diphtheria, 87
- fulminans, case, 253
- hæmorrhagica treated by blood-transfusion, 57
- PYELITIS**, 89
- PYLORUS** after gastro-enterostomy for congenital pyloric stenosis, 219
- obstruction of, in infants, 214
- pylorospasm, and allied spasms in infants, 214
- stenosis of (congenital), condition of pylorus after gastro-enterostomy for, 219
- PYLORUS**, stenosis of (congenital), in infant healed by gastro-enterostomy, 218
- in infancy, 214
- tumour of, congenital, X-ray examination following operation for, 219
- RABIES**, fatal case of, 249
- RACHITIC** deformities, unusual, 15
- Rappaport (B.) and Hektoen (L.)**, use of kaolin to remove bacteria from throat and nose, 349
- VON RECKLINGHAUSEN's disease**, see *Neuro-fibromatosis*.
- RECTUM**, mucous plug in, in newborn infant, case, 52
- REGURGITATION**, pulmonary, case, 143
- Reiche (F.)**, rare complications of diphtheria, 242
- RESPIRATION**, artificial, bearing of condition of larynx and trachea in still-born infants on, 366
- Reuben (M.)**, pyloric stenosis in infancy, 214
- Rhein (J. H. W.)**, insanity in children, 312
- spastic diplegia, 16
- tumour of the crus cerebri, 307
- RHEUMATIC** infection, 26
- infections in relation to school-life, discussion on, 186
- RHEUMATISM**, obscure manifestations of, 27
- RHINOLITH** of several years' duration, 124
- RIB** transplantation, two cases treated by, 287
- Richards (G. L.)**, relation of tonsils, adenoids, and other throat conditions to tuberculous cervical adenitis, 124
- RICKETS**, effect of sterilised milk upon, 150
- sex distribution of (J. Priestley), 173
- Ridlon (J.)**, coxa vara, 287
- Riesman (D.)**, lobar form of bronchopneumonia of long duration in children and young adults, 122
- Riggs (C. E.)**, juvenile paresis treated by intra-spinal injection of salvarsanised serum, 30
- RINGWORM**, X-ray treatment of, 253
- Risley (E. H.)**, pre-operative diagnosis of tubercular mesenteric and retro-peritoneal glands, 343
- Rist (E.)**, healing process of infantile bronchial glands in tuberculosis, 118
- Rivarola**, congenital spermatic cyst, 56
- Roberts (E. T.)**, medical inspection in relation to special schools, 187
- Roberts (P. W.)**, hygroma of groin, 55
- Robertson (M. E.) and Findlay (L.)**, some manifestations of congenital syphilis, 253
- Robertson (W.)**, isolation of scarlet fever, 21
- Robertson-Ross (J. M.)**, acute pemphigus complicating scarlet fever, 7

- Roch (V. D.)**, anti-gonococcal vaccine in ophthalmia neonatorum and infection of adults, 57
- Rocher (H. L.)**, congenital absence of left fibula, 224
- and **Souchet (J.)**, lumbo-sacral spina bifida with other deformities, 224
- Rogers (O. F., Jun.)**, positive skin tuberculin reactions, 345
- Rohmer (P.)**, combined adrenalin and pituitrin treatment, 60
- Rolleston (C.)**, Rutland County Council Education Committee; Annual Report of the School Medical Officer for the year 1913, 192
- Rolleston (H. D.)** and **Rolleston (J. D.)**, case of chronic lymphoid leukaemia with much temporary benefit from benzol treatment, 33
- Rolleston (J. D.)**, case of ectrodactyly, 240
- case of giant nevus, 12
- cerebral embolism in diphtheria, 49
- congenital heart disease and ulcerative sore throat, 85, 274
- Root lesions (multiple)**, herpes zoster, optic atrophy, choroiditis, congenital syphilis, syphilis meningo-vascularis (L. Guthrie and E. G. Fearnside), 206
- Rosenbloom (J.)** and **McKelvy (J. P.)**, cholesterol metabolism in case of congenital hæmolytic jaundice with splenomegaly, 217
- and **Stetten (D. W.)**, clinical and metabolic studies of case of hypopituitarism, 280
- Rovere (G.)**, recent studies on involution of thymus, 280
- Rowland (V. C.)**, congenital intestinal obstruction, 313
- ROYAL Society of Medicine**, Section for the Study of Disease in Children, proceedings, 10, 48, 84, 143, 239
- RUBELLA**, 22
- experimental study of, 22
- observations on, 247
- Ruh (H. O.)** and **Cole (H. N.)**, pemphigoid of newborn (pemphigus neonatorum), 51
- Rugh (J. T.)**, dislocation of the coccyx, 16
- RUMINATION** in association with persistent vomiting, 215
- RUMPEL-LEEDE** phenomenon in infective megalerythema, case, 245
- RURAL** districts, medical treatment of school-children in, 185
- Ryerson (E. W.)**, recurrent spondylolisthesis with paralysis, bone-splint transplantation, 285
- SAFETY-PIN** impacted in œsophagus, perforation of arch of aorta by (E. G. L. Goffe), 44
- open, in œsophagus, case, 123
- SACCHAROSE**, results of feeding sick children on 10 per cent. of, 338
- Saison** and **Sonné-Moret**, exophthalmic goitre in child, aged 8½ years, 338
- Saito (H.)**, rubella, 22
- SALT** fever and sugar fever in pædiatrics, 151
- SALTS** (mineral), significance of, in digestive disturbances of infants, 151
- Saner (F. D.)**, congenital syphilis, 84
- and **Barber (H. W.)**, enlarged liver, 85
- SÃO Paulo**, Mongolian blue spots at, 251
- SARCOMA** of tongue, 218
- SARCOMATA**, ovarian, three cases (T. T. Higgins), 161
- Sauer (L. W.)**, hemiparesis and hemiplegia as early symptoms of tuberculous meningitis, 344
- Sautelle (W. T. de)**, case of bacillus dysenteriae septicæmia, 249
- Savariaud**, adenitis of iliac fossa simulating coxalgia, 337
- SCABIES**, control and treatment of, 253
- SCALP**, pediculosis of, and eye disease, relation between, 157
- pulsating tumour of, 49
- SCAPULA**, congenital elevation of (Sprengel's deformity), 17
- — — of familial type, 222
- vicious attitude of, 223
- SCARLET** fever, abortive in first months of life, 245
- — and scarlatinal uræmia, meningeal conditions in, 20
- — attempts at production of, in monkeys, 19
- — cardio-vascular troubles in, 20
- — complicated by acute pemphigus (J. M. Robertson-Ross), 7
- — complications of, accessory nasal sinus inflammations in, 124
- — followed by gonococcus septicæmia with arthritis, 245
- — in Metropolitan Asylums Board Hospitals, 19
- — isolation of, 21
- — last epidemic of, in Warsaw, 19
- — malignant, use of blood-serum of immunes in treatment of, 59
- — pericarditis in, specimens shown, 50
- — peritoneal complications of, 19
- — return cases of, 21
- — unexplained œdema and pemphigus in convalescence from (R. Loy Wilcox), 9
- SCHICK** reaction, practical applications of, 243, 244
- toxin reaction for immunity, in diphtheria, 176
- Schindler (C.)**, Der Salvarsantod. Seine Ursache und seine Verhütung. Intravenöse oder intramuskuläre Salvarsan-injection? (review), 190

- Schippers (J. C.)**, the value of luetin reaction in pædiatrics, 255
 — and **Brouwer (B.)**, amyotonia congenita, 282
- SCHLATTER'S** sprain, two cases of, 288
- Schlemmer (A.)**, prognosis of whooping-cough in hospital, 24
- Schlutz (F. W.)**, absorption of fat from the intestinal tract of the actively tuberculous child, 118
- SCHMIDT'S** test, prognostic value of, in summer diarrhœa of infants, 154
- Schneider (W.)**, blood in pertussis, 177
- SCHOOL** and home life, co-ordination of, 185
 — children, economic importance of diseases of ear in, 188
 — — elementary, biometric and eugenic studies of, 184
 — — medical treatment of, in rural districts, 185
 — life, rheumatic infections in relation to, discussion on, 186
 — routine inspection of children in, true aim and purpose, 184
 — work of four years, review of, 184
 — **-HYGIENE**, present position of ophthalmology in, 187
- SCHOOLS**, special, medical inspection in relation to, 187
- Schorer (E. H.)**, intravenous injection of diphtheria antitoxin, 245
- Schreiber (G.)** and **François**, infantile scorbutus in a child fed on homogenised milk, 151
- Schroeder (L. C.)** and **La Fetra (L. E.)**, high caloric diet in typhoid fever, 248
- Schwens (H.)**, streptococcal peritonitis of genital origin, 222
- SCLERODERMIA** with congenital contractions and other defects, 144
- SCLEROSIS**, pulmonary, 123
- SCOLIOSIS**, congenital, so-called, 223
 — correction of, by Abbott's method, tetanus inoculated by felt employed in, 26
- SCORBUTUS**, infantile, 150
 — infantile, in child fed on homogenised milk, 151
- Scudder (C. L.)**, X-ray examination following operation for congenital pyloric tumour, 219
- SCURVY**, infantile, hæmatoma of lower lid, unusual manifestation of, in infant, aged 5 months (S. Stephenson), 77
- SEA-WATER** (Quinton's plasma) by ingestion in acute gastro-enteritis of newborn, 60
- SEMI-BLIND**, education of, 188
- SEPTICÆMIA** (gonococcus) with arthritis following scarlet fever, 245
- Sergent (Émile)**, *Études cliniques sur l'insuffisance surrénale* (Clinical Studies on Adrenal Insufficiency) (review), 189
- SERUM**, anti-meningococcal, efficacy of, in present epidemic of cerebro-spinal meningitis (A. Netter), 353
 — (anti-tetanic), subcutaneous injections of, three cases of tetanus cured by (J. Comby), 1
 — salvarsanised, intra-spinal injection of, in treatment of juvenile paresis, 30
- Sheldon (J. H.)**, congenital laryngeal stridor, 126
- Sheppard (J. E.)**, economic importance of diseases of the ear in school children, 188
- Sherman (De W.)** and **Johnes (H. R.)**, effect of sugars on the gastric secretions in infants, 151, 213
- Shrubsall (J. F. R.)**, discussion on rheumatic infections in relation to school life, 186
- SIGHT**, defective, Montessori education for children with (L. Paton), 129
- SIGMOID**, volvulus of, causing intestinal obstruction, 314
- Simon (T.)** and **Binet (A.)**, *Mentally Defective Children* (review), 160
- Sinclair (J. F.)** and **Speed (J. A.)**, œdema complicating gastro-enteritis, 176
- SINUS**, nasal accessory, inflammations of, complications of, in scarlet fever, 124
- Sironi (L.)**, paratyphoid fever, 26
- SKIAGRAPHY**, employment of, in diagnosis of thymus gland, 281
- SKIN**, diphtheria of, 27
 — laminar desquamation of, in newborn, 51
- Smeal (J. A.)**, case of multiple gangrene, 28
- Smith (G.)**, treatment of gonococcus vulvovaginitis; value of complement fixation test in management of, 90
- Smith (O. C.)**, hygroma cysticum colli and hygroma axillare, 54
- Smith (R. N.)**, tuberculosis in children, 116
- Smith (W. Mitchell)**, case of extensive pigmented and hairy nævus with molluscous tumours, 299
 — primary bronchial diphtheria, 331
- Société de Pédiatrie**, Paris, Proceedings, 337
- Sonnié-Moret** and **Saison**, exophthalmic goitre in child, aged 8½ years, 338
- SORE** throat, streptococci, early diagnosis of, 349
 — effect of vaccines in treatment of, 349
- Souchet (J.)** and **Rocher (H. L.)**, lumbosacral spina bifida with other deformities, 224
- Southworth (T. S.)**, influence of starch on infant digestion, 151
- SPASTIC** phenomena in Friedreich's disease, 10

- Speed (J. A.) and Sinclair (J. F.)**, oedema complicating gastro-enteritis, 177
- SPERMATIC** cyst, congenital, 56
- Spicer (W. T. Holmes)**, cysts in the anterior chamber arising from pars ciliaris retinae, 157
- Spiecker (A.)**, hereditary lues of nervous system (Friedreich's symptom complex), 29
- Spieler**, observations on rubella, 247
- SPINA** bifida and hydrocephalus with deformity of legs, 147
- (lumbo-sacral) with other deformities, 224
- SPINE**, bone plastic and graft operations on, for cure of Pott's disease, results of, 347
- fixed lateral curvature of, mechanics of plaster-of-Paris cast on, 285
- tuberculous disease of, bone transplantation (Albee method) for cure of, 285
- SPLEEN**, enlargement of, and anæmia; splenectomy; cure, 179
- SPLENECTOMY** in anæmia with enlargement of spleen, cure, 179
- in splenomegaly, 179
- SPLENOMEGALY** and congenital hæmolytic jaundice, cholesterol metabolism in case of, 217
- improved by antisyphilitic treatment, 13
- Spolverini (L. M.)**, pineal gland insufficiency in children, 280
- SPONDYLOLISTHESIS** (recurrent) with paralysis: bone-splint transplantation, 285
- SPRENGEL'S** deformity, case of, 223
- see also *Scapula*, congenital elevation of.
- SQUINT**, cure of, 159
- STAFFORDSHIRE** County Council, Annual Report of Medical Officer for 1913 (review), 191
- STAMINA** and physique, estimation of, for school purposes, 185
- Stamm (C.)**, melæna neonatorum, 53
- STARCH**, influence of, on infant digestion, 151
- Stauffer**, cervical adenitis, 125
- Stavsky (V.)**, mild forms of chronic infantile nephritis, 88
- Steele (H. M.) and Underhill (F. P.)**, presence of lactic acid in urine in cyclic vomiting, 88
- Stefano (De)**, tuberculous cardio-cirrhosis, 342
- Steindler (A.)**, coxa vara adolescentium traumatica, 287
- STERNUM**, congenital lymphangioma situated over, 318
- Stetten (de W.) and Rosenbloom (J.)**, clinical and metabolic studies of case of hypopituitarism, 280
- Stevens (H. C.)**, Mongolian idiocy and syphilis, 255
- Stephenson (S.)**, bacillus of bovine tubercle as factor in phlyctenular affections of eye, 156
- hæmatoma of the lower lid in infant aged 5 months; an unusual manifestation of infantile scurvy, 77
- and **Owen (S. A.)**, polio-encephalitis with ocular manifestations only, 85
- Stiles (H. J.)**, surgical tuberculosis, 316
- STILL'S** disease, 27
- and arthritis deformans, relation between, 27
- STIMULANTS** (cardio-vascular), use of strychnine and caffeine as, in acute infectious diseases, 184
- Stock (Mile S.)**, vaccinal allergy in the eruptive fevers, 22
- Stohl (H. F.) and Hublein (A. C.)**, tuberculosis of the bronchial glands and lung hilus, 118
- STOMACH**, congenital transposition of, to left side of chest, 213
- hernia of, through diaphragm, case (W. J. S. Bythell), 236
- Strauch (A.)**, epidemic icterus, 217
- myatonia congenita of Oppenheim, 282
- STREPTOCOCCUS** capsulatus, otitic meningitis due to, case, 123
- STRIDOR**, congenital laryngeal, 126
- Strina (F.)**, reaction to iodine of infants' faeces, 153
- STRYCHNINE** and caffeine, use of, as cardiovascular stimulants in acute infectious diseases, 184
- SUGAR**, high doses of, in treatment of vomiting infants and of marasmus, 60
- fever and salt fever in pædiatrics, 151
- SUGARS**, effects of, on gastric secretions in infants, 157, 213
- SUPRARENALS**, thymus, and pancreas in children, relation between, 279
- Sutherland (G. A.)**, case of myatonia congenita with dilatation of colon, 49
- *The Heart in Early Life* (review), 95
- Sutton (R. L.)**, trichotillomania, 312
- SYPHILIS** and Mongolian idiocy, connection between, 255
- congenital, case of, 84
- laboratory diagnosis in early stages of, 254
- some manifestations of, 253
- syphilis meningo-vascularis, choroiditis, optic atrophy, herpes zoster, multiple root lesions (L. Guthrie and E. G. Fearnside), 206
- *Treponema pallidum* found at autopsy in blood-stream in case of, 254
- hereditary, as social problem, 255
- comparison of results of luetin reaction and Wassermann reaction in, 29
- (late), diagnosis and treatment of, 255

- SYPHILIS**, infantile, 15
 — inherited, with Wassermann reactions, case, 144
 — see also *Antisyphilitic* treatment.
Swift (W. B.), voice sign in chorea, 311
Sympa (L.), case of infective megalerythema with Rumpel-Leede phenomenon, 245
- TACHYCARDIA** and bradycardia, 183
Takahashi (A.), ecthyma gangrænosum in measles, 247
Talbot (F. B.) and **Benedict (F. G.)**, gaseous metabolism of infants, 152
TALIPES equinus, 316
Tebbutt (A. H.), influenzal meningitis, 93
TEETH, prenatal eruption of, significance of, 212
Teissier (P.), peritoneal complication of scarlet fever, 19
TENDON reflexes, 305
Tenner (A. S.), otitic pneumococcic bacteræmia, 347
TERRATOMA of pharynx, 87, 125
Terreros (D. C. Sainz de los), Tetania Infantil (review), 368
TESTICLE, double-retained, in which left testicle was transplanted to right side of scrotum, and right testicle to left side, 13
TETANUS cured by subcutaneous injections of anti-tetanic serum, three cases (J. Comby), 1
 — inoculated by felt employed in correction of scoliosis by Abbott's method, 26
TETANY, infantile, case of, 312
Thomas (H. B.), so-called congenital scoliosis, 223
Thomas (H. M.) and **Blackfan (K. S.)**, recurrent meningitis, due to lead, 311
Thompson (A. H.), dilated pupil of Argyll-Robertson type, 157
Thompson (W. L.), intestinal putrefaction with convulsions, 218
THORACIC dullness, significance of certain areas of, 342
THROAT and nose, use of kaolin to remove bacteria from, 349
 — sore, ulcerative, and congenital heart disease, 85
 — — — — — (J. D. Rolleston), 274
THROATS, diphtheritic, use of living lactic acid bacilli in, 59
THYROIDITIS, acute influenzal, and Pott's disease, 317
Thursfield (H.), child with defective patellæ and contraction of limbs, case for diagnosis, 239
 — and **Gow (A. E.)**, splenomegaly: splenectomy, 179
THYMECTOMY, 314
THYMUS gland, employment of skiagraphy in diagnosis of, 281
- THYMUS**, enlarged, and atelectasis, case, 281
 — hypertrophy of, employment of Röntgen rays in, 61
 — involution of, recent studies of, 280
 — suprarenals, and pancreas in children, relation between, 279
TIBIÆ, double osteotomy of, ten years after operation, case, 212
Tilley (H.), the tonsils as source of local and systemic infection, 347
Tobias (A.), Zur Prognose und Aetiologie der Kinder-Hysterie (review), 96
TONGUE, long-standing superficial ulceration of, in association with ichthyosis, 143
 — sarcoma of, 218
TONSIL, round worm within body of, 348
TONSILLAR fosse, post-operative antiseptic treatment of, 349
TONSILLECTOMY versus tonsillotomy, 125
TONSILLITIS, acute, followed by retro-pharyngeal abscess, with rupture, asphyxiation, and death, 125
TONSILS, adenoids and other throat conditions, relation of, to tuberculous cervical adenitis, 124
 — and adenoids, indications for removal of, 113
 — as source of local and systemic infection, 347
 — infection through, 112
 — relations of, to tuberculosis, 111
TOOTH erupted at birth, child with, 10
TRACHEA, casts of, in diphtheria, 350
 — and larynx, condition of, in still-born infants; bearing of, on artificial respiration, 366
TRANSACTIONS of the American Pediatric Society (review), 352
TRAUMA, single, followed by myositis ossificans, 283
TREPONEMA pallidum found at autopsy in blood-stream and elsewhere in case of congenital syphilis, 254
Trèves and **Phélip**, acute influenzal thyroiditis and Pott's disease, 317
Triboulet (H.) and **Godlewski (H.)**, seawater (Quinton's plasma) by ingestion in acute gastro-enteritis of newly born, 60
 — (and others), hæmorrhagic conditions in late childhood, 337
TRICHOTILLOMANIA, 312
Trouveller (E.), lumbar puncture in newborn, 52
TUBERCLE, bovine, bacillus of, as factor in phlyctenular affections of eye, 156
TUBERCLE-BACILLUS, bovine infection with, 117
TUBERCULIN reactions, positive skin, 345
 — test, cutaneous, in children of non-tuberculous parentage, 345

TUBERCULOMA of pons Varolii, and pulmonary tuberculosis, death, necropsy (L. Guthrie), 225

TUBERCULOSIS, 340

- absorption of fat from intestinal tract in, 118
- acute general, in infant, 120
- as disease of newborn, 339
- association of erythema nodosum with, 119
- bovine, relation of, to early tuberculosis, 118
- care of children suffering from, 346
- congenital, 339
- diagnosis, 117
- — and treatment of, 117
- early, relation of bovine tuberculosis to, 118
- (experimental), cuti-reaction in, 344
- in children, 116
- in infancy, bronchogenous, placentogenous, dermatogenous, and enterogenous infection with, 119
- incidence of, in childhood, 115, 340
- infection of, in young children; occurrence of, in cases of malnutrition, 116
- inheritance of, 339
- lesions in infants, study of, based on post-mortem examination, 340, 341
- miliary, culture of *B. tuberculosis* from blood, post mortem, of case of, 120
- milk supply as causal factor in relation to, 117
- of auditory apparatus; internal hydrocephalus; permanent drainage of lateral ventricle (C. E. West), 171
- of bronchial glands and lung hilus, 118
- of hernial sac, 221
- of infantile bronchial glands, healing process of, 118
- of liver in infant, aged 3 months, 343
- of lymph glands, bacteriological study of, 117
- pulmonary, and tuberculoma of pons Varolii, death, necropsy (L. Guthrie), 225
- — early, in childhood, 116
- — in children (J. M. Campbell), 198
- — incidence of (S. W. M'Lellan), 115
- — with laryngo-pharyngeal stenosis, 342
- relations of tonsils to, 111
- surgical, 316
- transmission of, in childhood, 340
- water in prevention and cure of, 346
- X rays in, 117

TUBERCULOUS tumours of brain, 309

Turner (C. Violet), case of liver abscess, 107

Turner (E. V.) and Pritchard (E.), case of liver abscess in infant, 50

Turner (P.), case of double-retained testicle in which the left testicle was transplanted to the right side of the scrotum and the right testicle to the left side, 13

- hydrocephalus and spina bifida with deformity of the legs, 147
- pulsating tumour of the scalp, 49
- seasonal enlargement of the parotid glands, 14

TYPHOID fever, 248

- — acute inflammation of gall-bladder in, 25
- — high caloric diet in, 248
- — in early life, 25
- — prognosis of, in children in Paris hospitals, 25
- — with regular course in infant, aged 7 months, 25
- — see also *Meningitis* (typhoid, cerebro-spinal), *Periostitis* (typhoid).

UMBILICAL infections, 53

Underhill (E. P.) and Steele (H. M.), presence of lactic acid in urine in cyclic vomiting, 88

URÆMIA (scarlatinal) and scarlet fever, meningeal conditions in, 20

URINE, bile salts and pigments in, relation of, to hæmokoniasis, 337

- of infants, organic acids in, 87
- presence of lactic acid in, in cyclic vomiting, 88

URTICARIA papulosa, 251

VACCINAL allergy in eruptive fevers, 22

VACCINE (anti-gonococcal) in ophthalmia neonatorum and infection of adults, 57

VACCINES, effect of, in treatment of streptococcal sore throat, 349

- in prophylaxis and treatment of pertussis, 58
- use of, in treatment of chronic diphtheria carriers, 59

VACCINIA, generalised, case of, 247

VAGINITIS, tuberculous, 343

Yan't Hoff (G.), diphtheria bacillus carriers, 19

VARICELLA in adenopathic child, meningeal syndrome supervening on, 338

Variot (G.), sterilised milk and rickets, 150

— and **Cailliau**, congenital labial hemispasm and malformation of ears, 338

Yas (J.), tendon reflexes, 305

Yeale (P. J.) and Coombs (Carey), cardiac failure in child, aged 6 years, associated with atheroma of pulmonary artery and extreme dilatation of right ventricle, 72

- Veeder (B. S.)**, duodenal ulcers in infancy, 216
- and **Jeans (P. C.)**, diagnosis and treatment of late hereditary syphilis, 255
- VENTRICLE**, lateral, permanent drainage of, in tuberculosis of auditory apparatus and internal hydrocephalus, case (C. E. West), 171
- (cardiac) right, extreme dilatation of, and atheroma of pulmonary artery in association with cardiac failure in child, aged 6 years (P. J. Veale and Carey Coombs), 72
- VICTORIA**, Report of Minister of Public Instruction for 1912-13 (review), 192
- VINCENT'S** organisms, infection of middle ear with (J. Adam), 40
- Vioran (R. L.)**, umbilical infections, 53
- VISION**, defective, education of children with (N. Bishop Harman), 257, 289
- VOICE**, relation of lymphoid tissue of upper air-passages to, 114
- sign in chorea, 311
- VOLVULUS** of sigmoid, intestinal obstruction due to, 314
- VOMITING**, cyclic, presence of lactic acid in urine in, 88
- of infants, treatment of, by high doses of sugar, 60
- persistent, associated with rumination, 215
- recurrent, beta-oxybutyric acid determinations in, 215
- one hundred and forty-one cases of, 215
- VULVO-VAGINITIS**, 89
- (gonococcus), treatment of, value of complement fixation test in management of, 90
- Wachenheim (F. L.)**, hemimelia thoracica, 223
- Wade (H. W.)**, congenital inguinal implantation of vermiform appendix, 221
- Wagner (E. A.)** and **Friedlander (A.)**, diagnosis of whooping-cough by the complement-deviation test, 24
- WARSAW**, last epidemic of scarlet fever in, 19
- WASSERMANN** reaction and luetin reaction, comparison of results of, in hereditary syphilis, 29
- reactions in inherited syphilis, case, 144
- WATER** in prevention and cure of tuberculosis, 346
- Watson (E. J.)**, X-ray treatment of ring-worm, 253
- WEANING**, remarks on, 147
- Weber (F. Parkes)**, lymphocytomatosis or lymphoblastomatosis, especially of the kidneys, 268
- Weigert (R.)**, meningocele, a rare complication of whooping-cough, 24
- WEIGHT**, physiological loss of, in newly-born children, cause of, 51
- Weil (A. T.)**, use of vaccines in treatment of chronic diphtheria carriers, 59
- Weill** and **Mouriquand** researches on alimentary diseases due to defect, 338
- and **Marie**, clinical form of tuberculous meningitis beginning with paralysis of oculo-motor nerve, 159
- Weinstein (J.)**, deafness following mumps, 347
- Wentworth (M. H.)** and **Lucas (W. P.)**, out-patient treatment of rheumatic endocarditis, 60
- Wery** and **Gandier**, thymectomy, 314
- West (C. E.)**, case of tuberculosis of the auditory apparatus; internal hydrocephalus; permanent drainage of lateral ventricle, 171
- Weston (W.)**, pellagra in early childhood, 28
- Wheeler (W. I. de C.)**, two cases treated by rib transplantation, 287
- Whipham (T. R.)**, congenital heart-block, 321
- diabetes insipidus with infantilism, 12
- two cases of heart-block, 11
- WHOOPING-COUGH**, 348
- clinical and sociological aspects of, 23
- constitutional tendency to asphyxia and continued fever in, 248
- diagnosis of, by complement-deviation test, 24
- in Metropolitan Asylums Board Hospitals, 23
- meningocele, rare complication of, 24
- prognosis of, in hospital, 24
- Wilbouchewitch (N.)**, vicious attitude of scapula, 223
- Wilcox (R. Loy)**, case of unexplained œdema and pemphigus in convalescence from scarlet fever, 9
- Williams (A. E.)**, medical treatment of school-children in rural districts, 185
- Williams (A. W.)**, ætiology of pertussis, 23
- causes and treatment of chronic conjunctival affections, 156
- Williams (E. C.)**, occurrence of acidosis in children, 327
- Williams (L.)**, dental clinics, 189
- Williams (T. A.)**, cause and cure of night terrors, 312
- Wilson (D. S.)**, pulmonary tuberculosis with laryngo-pharyngeal stenosis, 342
- Wishard (G.)**, conservation of hearing, 123
- Wolfer (L.)**, review of four years' school work, 184
- Wollstein (M.)** and **Bartlett (F. H.)**, study of tuberculous lesions in infants and young children based on post-mortem examination, 340, 341

- Wood (C. I.)**, significance of the mineral salts in the digestive disturbances of infants, 151
- Wood (G. B.)**, infection through the tonsils, 112
- Woodhead (G. Sims)**, incidence of tuberculosis in childhood, 115
- Woodruff (I. O.)**, care of tuberculous children, 346
- WORM**, round, within body of tonsil, 348
- Wright (H. W.)**, infantile hemiplegia, 307
- WRIST**, extra genital primary chancre of (G. Pernet), 296
- Wyman (E. T.)**, pyelitis, 89
- and **Morse (J. L.)**, blood-pressure in anæmia in infancy, 181.
- Wynkoop (E. J.)**, atypical pneumonias of infancy and childhood, 122
- von Wyss (W. H.)** and **Batten (F. E.)**, atonic form of cerebral diplegia, 65
- — — — — (Foerster), case, 143
- X-RAY** examination following operation for congenital pyloric tumour, 219
- X-RAY** treatment of ringworm, 253
- X-RAYS**, employment of, in hypertrophy of thymus, 61
- in tuberculosis, 117
- YEAR-BOOK** of Open-air Schools and Children's Sanatoria, edited by T. W. Kelynack (review), 159
- Yearsley (M.)**, retrospect of otology, 1914, 109
- Young**, congenital club-foot, 16
- Young (W. A. B.)**, tuberculous infection in young children, with special reference to its occurrence in cases of malnutrition, 116
- Zahorsky (J.)**, bradycardia and tachycardia, 183
- heat and summer diarrhoea, 154
- Zuber** and **Chatelin**, case of pseudomeningocele, 311



